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IAA (A-10000 Series)

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ENERGY

A Continuing Bibliography

With Indexes

Issue 25

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced from January 1 through March 31, 1980 in:

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

INTRODUCTION

This issue of *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043(25)) lists 1428 reports, journal articles, and other documents announced between January 1, 1980 and March 31, 1980 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of this continuing bibliography was published in May 1974 and succeeding issues are published quarterly.

The coverage includes regional, national and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution and storage, with special emphasis on use of hydrogen and of solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries* in that order. The citation, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR* including the original accession numbers from the respective announcement journals. This procedure, which saves time and money accounts for the slight variation in citation appearances.

Five indexes -- subject, personal author, corporate source, contract number, and report number -- are included. The indexes are of the cumulating type throughout the year, with the fourth quarterly publication containing abstracts for the fourth quarter and index references for the four quarterly publications.

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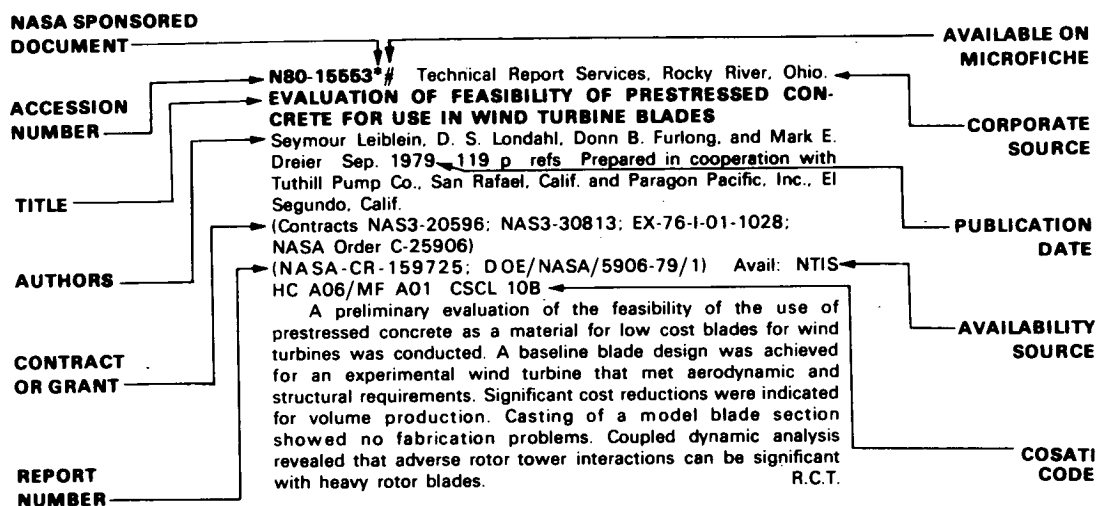
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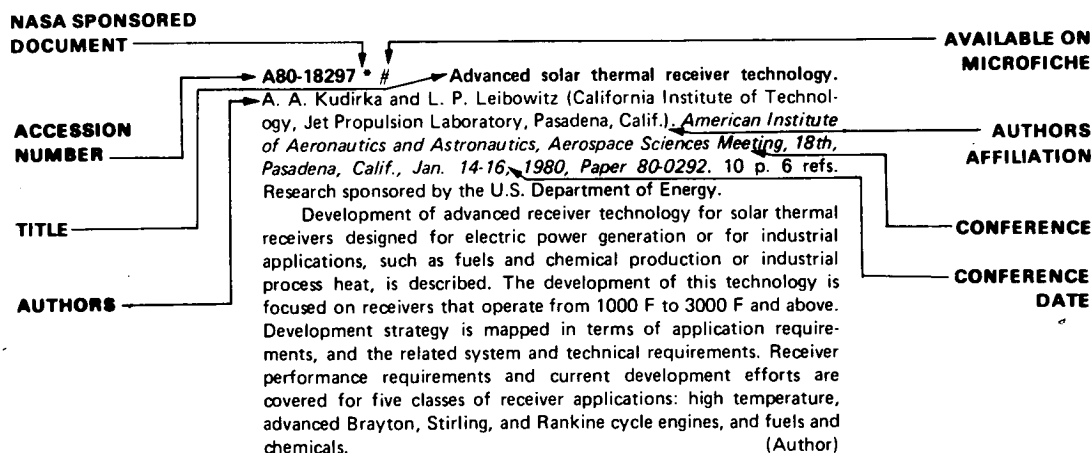
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TYPICAL CITATION AND ABSTRACT FROM IAA



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p0094 N80-10397
2. Hydrogen production. Citations from the international aerospace abstracts data base
p0094 N80-10401
3. Hydrogen storage as a hydride. Citations from the international aerospace abstracts data base
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APRIL 1980

IAA ENTRIES

A80-10028 Experimental techniques and mathematical models in the study of waste pyrolysis and gasification. A. G. Buekens, J. J. R. Mertens, J. G. E. Schoeters, and P. C. Steen (Brussel, Vrije Universiteit, Brussels, Belgium). (*World Recycling Congress, 1st, Basel, Switzerland, Mar. 6-8, 1978.*) *Conservation and Recycling*, vol. 3, no. 1, 1979, p. 1-23. 36 refs.

Thermogravimetric analysis coupled with gas chromatography and mass spectrometry is used to study the weight loss of various samples and monitor the composition of the evolved volatile products. In addition, pyrolysis gas chromatography is applied for the scanning of pyrolysis rates and product distributions over a wide range of experimental conditions. Attention is given to the testing of a two phase model of a fluidized bed reactor for the case of polystyrene pyrolysis. Finally, the effect of the operation parameters on the production of styrene is discussed, noting that the computed results were in fair agreement with the literature data. M.E.P.

A80-10029 Resource recovery systems costs. B. M. Fabuss, D. B. Spencer, and R. L. Schroeder (Raytheon Service Co., Burlington, Mass.). (*World Recycling Congress, 1st, Basel, Switzerland, Mar. 6-8, 1978.*) *Conservation and Recycling*, vol. 3, no. 1, 1979, p. 77-89. U.S. Environmental Protection Agency Contract No. 68-01-4380.

The investment cost, operating cost and overall economics of resource recovery plants handling 500 to 2,000 tons per day of municipal solid waste were determined. These plants recover only refuse derived fuel and ferrous metal from the waste. Additional economics have been developed for plants recovering other products. (Author)

A80-10043 * # The erosion/corrosion of small superalloy turbine rotors operating in the effluent of a PFB coal combustor. G. R. Zellars, S. M. Benford, A. P. Rowe, and C. E. Lowell (NASA, Lewis Research Center, Cleveland, Ohio). *U.S. Department of Energy and Electric Power Research Institute, Conference on Advanced Materials for Alternate Fuel Capable Directly Fired Heat Engines, Castine, Me., July 30-Aug. 3, 1979, Paper. 25 p.* 10 refs.

The operation of a turbine in the effluent of a pressurized fluidized bed (PFB) coal combustor presents serious materials problems. Synergistic erosion/corrosion and deposition/corrosion interactions may favor the growth of erosion-resistant oxides on blade surfaces, but brittle cracking of these oxides may be an important source of damage along heavy particle paths. Integrally cast alloy 713LC and IN792 + Hf superalloy turbine rotors in a single-stage turbine with 6% partial admittance have been operated in the effluent of a PFB coal combustor for up to 164 hr. The rotor erosion pattern exhibits heavy particle separation with severe erosion at the leading edge, pressure side center, and suction side trailing

edge at the tip. The erosion distribution pattern gives a spectrum of erosion/oxidation/deposition as a function of blade position. The data suggest that preferential degradation paths may exist even under the targeted lower loadings (less than 20 ppm). S.D.

A80-10109 # Conceptual design, realization and experimentation of a concentration photovoltaic generator - SOPHOCLE 1000 prototype (Conception, réalisation et expérimentation d'un générateur photovoltaïque à concentration - Prototype SOPHOCLE 1000). D. Folléa. Toulouse III, Université, Docteur-Ingénieur Thesis, 1979. 85 p. 21 refs. In French.

The work is concerned with the development of a photovoltaic generator of the concentration type that provides improvements in efficiency and cost. The conceptual design, based on thermal stress, leads to a relatively flexible structure characterized by passive cooling, a concentration level of approximately 40 suns, and a surface of cells equal to 4 sq cm. Results of experiments performed on the SOPHOCLE 1000 (SOLAIRE PHOTOVOLTAÏQUE À CONCENTRATION Limitée d'Énergie) prototype confirmed the homogeneity of the structure, and provided performance estimates at the prefabrication stage. Future work should consider the development of high-efficiency (no less than 30 percent) solar cells, along with the realization of active-cooling structures. S.D.

A80-10199 # An engine fuel chemistry solution to the problem of jet fuel supplies (Khimmotologicheskie resheniya problemy resursov reaktivnykh topliv). V. A. Piskunov, K. S. Chernova, P. A. Mikheichev, N. P. Iurukovskii, and V. N. Zrel'ov. *Khimiia i Tekhnologiia Topliv i Masel*, no. 10, 1979, p. 35-38. 8 refs. In Russian.

Fuel refining techniques are discussed as means of increasing jet fuel supplies. It is shown that expanding the boiling range of jet fuel allows a greater yield from crude oil, at the expense of diesel fuel fractions, and increases the concentration of aromatic hydrocarbons in the jet fuel fractions. Investigations of the behavior of lower-quality fuels (with elevated crystallization temperatures) under simulated flight temperatures and means of controlling fuel flow and combustion properties under these conditions are discussed. Results indicating the decrease of low temperature Jet A-1 fuel fluidity with paraffin content and the increase in combustion chamber temperature with increasing hydrocarbon content are presented, emphasizing the applicability of engine fuel chemical analysis to the interactions of fuel properties, aviation technology and operational conditions. A.L.W.

A80-10223 # A mathematical model for a future hydrogen power system (Model matematic pentru un viitor sistem energetic hidrogetic). I. Ursu (Bucuresti, Universitatea, Bucharest, Rumania) and M. Pavelescu (Institutul de Reactori Nucleari Energetici, Bucharest, Rumania). *Studii si Cercetari de Fizica*, vol. 31, no. 8, 1979, p. 815-841. 13 refs. In Rumanian.

The paper introduces a mathematical model for a global energetic system based on hydrogen as an energy vector. The global system is defined as being formed by two partial systems, namely: an electric power and a hydrogen thermal power system. The best way to utilize nuclear energy for hydrogen production is investigated. It

shown that HTGR's and GCFBR's are the most attractive for this goal and therefore such reactors are considered as part of the second partial system. By application of the mathematical model it was possible - by help of a STEH code - to obtain numerous results which allow various interesting conclusions concerning this future power system. (Author)

A80-10226 Rapid devolatilization and partial gasification of coal in an entrained dust reactor (Schnellentgasung und Teilvergasung von Steinkohle im Flugstaubreaktor). K. Hedden, R. Hauk, and L. Huber (Karlsruhe, Universität, Karlsruhe, West Germany). *Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoff-Chemie*, vol. 32, Sept. 1979, p. 423-429. 11 refs. In German. Research supported by the Bundesministerium für Forschung und Technologie.

The article surveys the results of laboratory experiments carried out to determine the optimum conditions for a high degree of desulfurization during rapid devolatilization and partial gasification. The yields and the composition of the gaseous and liquid products obtained during devolatilization are determined with regard to the application of the process for the production of chemical raw materials. In the investigation of rapid devolatilization it was found that more volatiles and therefore more sulfur were expelled by the rapid heating of carbon particles than by chamber carbonization. Finally, it is reported that more than 85 vol.-% of the gas obtained during devolatilization were methane, hydrogen, and carbon monoxide, while hydrogen, carbon monoxide, and carbon dioxide were the main constituents of the gas from partial gasification. M.E.P.

A80-10228 Models of worldwide energy demand and consumption (Modelle für Energiebedarf und -verbrauch in weltweitem Rahmen). W. Häfele and L. Schratzenholzer (Internationales Institut für angewandte Systemanalyse, Laxenburg, Austria). *Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoff-Chemie*, vol. 32, Sept. 1979, p. 447-451. In German.

An attempt is made to present two globally consistent scenarios for the development of the energy system in the next 50 years. The scenarios are based on high and low increases in energy demand. They consider a 5 kW and 3 kW per person energy consumption rate, respectively, in the year 2030. Factors considered and discussed include world population, economic development, energy demand, demand coverage, and economic consequences. In conclusion it is noted that other factors considered include an analysis of the foreseeable development of the world market for crude oil, a study of global restrictions, and determining the potential of alternate energy carriers and technologies. M.E.P.

A80-10285 A review of in situ composites for nonstructural applications. A. S. Yue (California, University, Los Angeles, Calif.). In: Conference on In Situ Composites, 3rd, Boston, Mass., November 29-December 1, 1978, Proceedings. Lexington, Mass., Ginn Custom Publishing, 1979, p. 171-184. 36 refs. Research supported by the U.S. Department of Energy and U.S. Air Force.

A review of directionally solidified (DS) eutectics for electronic, magnetic, thermomagnetic, and superconducting applications and potential uses for optical waveguides and energy conversion is presented. The anisotropy of resistances utilized in electronic devices, and image transmission properties of optical fiber eutectics are discussed. Applications for solar cell applications are described, noting that a lamellar (or fiberlike) semiconductor eutectic can be used for converting solar radiation into electricity. Finally, it is suggested that it is necessary to select a correct eutectic system for each application, and to obtain as nearly perfect a microstructure as possible for nonstructural applications. A.T.

A80-10306 Microstructural objectives for high-temperature alloys in advanced engine systems. C. T. Sims (General Electric Co., Gas Turbine Div., Schenectady, N.Y.). In: MiCon 78: Optimization of processing, properties, and service performance

through microstructural control; Proceedings of the Symposium, Houston, Tex., April 3-5, 1978. Philadelphia, Pa., American Society for Testing and Materials, 1979, p. 480-513. 18 refs.

This paper reviews six advanced systems in a broad fashion helpful in orientation of engineering and technical personnel not directly involved in such developments. These are coal utilization systems including coal liquefaction, coal gasification and pressurized fluid beds, nuclear systems including liquid metal fast breeder reactors (LMFBR), and high-temperature gas reactors (HTGR). In concert with these systems, yet cross-functioning, superalloy technologies are discussed for combined-cycle electrical plants and high-temperature heat exchangers. Then potential applications and problems for superalloys in the systems, are identified, drawing from this base examples that might typically be applied, utilizing these to discuss ideal microstructures one may find. (Author)

A80-10321 The electric trolley bus - Revisited. J. W. Schumann (Sacramento Regional Transit District, Sacramento, Calif.) and B. J. Hanson (Louis T. Klauder and Associates, Philadelphia, Pa.). *Traffic Quarterly*, vol. 33, Oct. 1979, p. 577-587.

New interest in public transit, as a way to provide relief from the energy crisis and to reduce pollution, has led to a reevaluation of the potential of the electric trolley bus (ETB). This paper reviews current trends in the ETB field and discusses such new ETB system consideration as improved vehicle design, electric power distribution systems, electric power generation/conversion, off-wire systems, and network operations. Attention is also given to such factors as community esthetics and pollution, energy consumption, and research needs. B.J.

A80-10323 Back to the central city - Myths and realities. G. Sternlieb (Rutgers University, New Brunswick, N.J.) and J. W. Hughes (Rutgers University, Livingston and New Brunswick, N.J.). *Traffic Quarterly*, vol. 33, Oct. 1979, p. 617-636. 5 refs.

The paper brings together available statistical data for speculation on the future of the central city, with primary emphasis on demographic trends and their policy implications. It is noted that the future demand for central city transportation is a function of its resident population, nonresident workers, and nonresidents attracted to the city for a variety of non-job related purposes. It is concluded that, subject to limitations and financial resource, the central city core transportation issue is largely being blunted not by new means of transit but rather by decline in need. B.J.

A80-10324 Forecasting automobile fleet fuel efficiency. F. L. Mannering and K. C. Sinha (Purdue University, Lafayette, Ind.). *Traffic Quarterly*, vol. 33, Oct. 1979, p. 637-648. 10 refs. Research supported by Purdue University and Indiana State Highway Commission.

The paper presents a modeling procedure developed as part of a computer simulation model used to project statewide highway financing and system performance. This automobile fleet fuel efficiency model considers impacts of prevailing economic conditions, governmental policy decisions regarding new vehicle fuel efficiency standards, and auto usage characteristics, all of which are vital to the accurate projection of automobile fleet fuel efficiency. The basic approach is to: (1) determine the number of automobiles in use by model year, (2) estimate automobile fuel efficiencies by model year, and (3) establish relative automobile usage by model year. Projection of automobile fleet fuel efficiency was necessary to estimate future highway fuel consumption, revenues derived from fuel taxes, and other related factors affecting highway transportation system performance. B.J.

A80-10349 # Hydrogen - The fuel of the future (Vodorod - Toplivo budushchego). A. N. Podgorniy and I. L. Varshavskii. Kiev, Izdatel'stvo Naukova Dumka, 1978. 136 p. 129 refs. In Russian.

The application of hydrogen as fuel in various areas of the economy is examined. Consideration is given to the physico-chemical properties of hydrogen, chemical, thermal, electrochemical and

thermochemical means of obtaining hydrogen, and hydrogen transport and storage in the form of metal hydrides. The use of hydrogen as a fuel in internal combustion, Stirling, rocket, jet and heat engines is discussed, and results of experimental investigations on internal combustion engines based on hydrogen and hydrogen-gasoline-air mixtures are reported. A.L.W.

A80-10474 Power supply requirements for a tokamak fusion reactor. J. N. Brooks and R. L. Kustom (Argonne National Laboratory, Argonne, Ill.). *Nuclear Technology*, vol. 46, Nov. 1979, p. 61-81. 10 refs. Research supported by the U.S. Department of Energy.

The power supply requirements for a 7-m major radius commercial tokamak reactor have been examined, using a system approach combining models of the reactor and poloidal coil set, plasma burn cycle and magnetohydrodynamics calculations, and power supply characteristics and cost data. A conventional system using a motor-generator flywheel set and solid-state rectifier/inverter power supplies was studied in addition to systems using a homopolar generator, superconducting energy storage inductor, and dump resistors. The requirements and cost of the power supplies depend on several factors but most critically on the ohmic heating ramp time used for startup. Long ramp times (at least about 8 s) seem to be feasible, from the standpoint of resistive volt-second losses, and would appear to make conventional systems quite competitive with nonconventional ones, which require further research and development. (Author)

A80-10524 Salinity gradient power - Utilizing vapor pressure differences. M. Olsson (California, University, La Jolla; Foundation for Ocean Research, San Diego, Calif.), G. L. Wick (Institute for Transcultural Studies, Los Angeles, Calif.), and J. D. Isaacs (California, University, La Jolla; Foundation for Ocean Research, San Diego, Calif.). *Science*, vol. 206, Oct. 26, 1979, p. 452-454. 12 refs. Grant No. NOAA-04-6-158-4410.

By utilizing the vapor pressure difference between high-salinity and low-salinity water, one can obtain power from the gradients of salinity. This scheme eliminates the problems associated with conversion methods in which membranes are used. The method tested in the present investigation gave higher conversion efficiencies than membrane methods. Furthermore, hardware and techniques being developed for ocean thermal energy conversion may be applied to this approach to salinity gradient energy conversion. (Author)

A80-10613 Selection of optimal parameters of heat-pipe heat exchanger for a gas turbine engine. N. V. Lokai and I. I. Mosin. (*Aviatsionnaya Tekhnika*, vol. 22, no. 1, 1979, p. 41-46.) *Soviet Aeronautics*, vol. 22, no. 1, 1979, p. 30-34. 5 refs. Translation.

Some means of achieving maximum degree of regeneration in a heat exchanger with heat pipes are investigated by extending some previous analysis methods for heat exchangers with intermediate heat carrier. Two conditions are found which must be satisfied in order to achieve maximum degree of regeneration: (1) the heat transmitting power of the heat pipes must exceed the heat release intensity from both the gas and air directions; and (2) two dimensionless parameters for the gas and air sides must be equal. P.T.H.

A80-10823 # Development of an aircraft-derivative gas turbine with high performance and large output. Y. Shimura (Ishikawajima-Harima Heavy Industries Co., Ltd., Turbine and Compressor Engineering Div., Tokyo, Japan) and K. Takeo (Ishikawajima-Harima Heavy Industries Co., Ltd., Turbine Design Dept., Tokyo, Japan). *IHI Engineering Review*, vol. 12, July 1979, p. 29-32.

The design and performance of the 50,000 horsepower IM5000 industrial gas turbine are examined. Attention is given to the gas generator which is an industrial version of the GE CF-6 turbofan engine. The power turbine is described, noting that it can be used for generating 50/60-Hz power and mechanical drive applications. Areas of the power turbine examined include aerodynamic design, basic construction design concept, and component design such as buckets,

vanes, rotor, transition duct, turbine casing, exhaust casing, and exhaust scroll. Finally, it is reported that tests revealed higher performance than predicted, and that NO(x) emissions are reduced with a water injection system. M.E.P.

A80-10842 Energy conservation through recycling. D. C. Wilson (Atomic Energy Research Establishment, Waste Research Unit, Harwell, Oxon, England). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 307-323. 53 refs.

Best estimates of the energy savings due to recycling one ton of several materials are suggested by means of a critical review of the literature. Further the use of these estimates is demonstrated by a number of illustrative applications. It is shown that while substantial energy savings may be made by recycling most metals or paper, the savings from reclaiming glass cullet are marginal, although there is potential for energy conservation through the use of returnable as opposed to nonreturnable bottles. It is reported that the recycling of materials saves about 5% of the total energy requirement of the U.K. Finally, the recovery of fuel products and/or materials from solid waste is also shown to be an attractive and efficient energy source. M.E.P.

A80-10843 Second-law analysis of solar-thermal processes. J. F. Kreider. *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 325-331. 6 refs.

The second law of thermodynamics provides an analytic framework for the assessment of the potential displacement of fossil fuels by solar energy. The most promising areas are those which have entropy levels corresponding to the entropy level of the solar resource as converted to heat in various types of solar collectors. Since the entropy of solar heat can be partitioned by the means of collection - e.g., by the collector concentration ratio - solar can be matched much more precisely to many tasks at temperatures up to 300 C than can fossil fuels which are low entropy sources now widely misused for high entropy tasks. (Author)

A80-10844 The assessment of actual wind power availability in Ireland. J. Haslett and E. Kellely (Trinity College, Dublin, Ireland). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 333-348. 18 refs.

A80-10845 A new approach to low cost large area selective surfaces for photothermal conversion. B. K. Gupta, F. K. Tiwari, O. P. Agnihotri, and S. S. Mathur (Indian Institute of Technology, New Delhi, India). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 371-377. 8 refs.

Selective black paint coatings have been prepared by coating reflective metal particles with a layer of selective black material. The coated particles were mixed in a binder and applied easily as a thin layer onto aluminum or galvanized iron (G.I.) sheet. Three selective black materials, namely CuO, CuS and PbS + CuS have been deposited on zinc metal powder. The solar absorptance of the coatings is about 0.95 and the emittance is about 0.4. The thickness of the coatings was about 20 to 30 microns. The emissivity decreases as the thickness increases, while the solar absorptivity does not change appreciably. The improvement in the collector efficiency, which is the ratio of the temperature increase above the temperature of the standard panel to the temperature increase of the standard panel above the ambient temperature, is estimated to be around 11 per cent. The process is potentially a low cost one for large scale application in solar photothermal conversion. (Author)

A80-10846 Performance of an inexpensive constant flow solar collector/storage system in ground. M. S. Sodha, A. Srivastava, G. N. Tiwari, S. C. Kaushik (Indian Institute of Technology, New Delhi, India), and M. A. S. Malik (Kuwait Institute of Scientific Research, Safat, Kuwait). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 379-387.

This paper presents an analysis of the performance of an inexpensive constant flow solar collector/storage system, which has been validated by experiments. The system consists of a network of pipes buried in the ground, the top surface of the ground being

blackened by black board paint spray and suitably glazed. The heat can be extracted by flow of fluid in the pipes at a constant flow rate. It is seen that for a 7 cm depth of the plane of heat retrieval and 8 l/min flow rate of water, the collection efficiency of the system is 20.0 per cent. The efficiency increases with flow rate and decreases with the depth of the plane of heat retrieval. (Author)

A80-10847 Using a fin with a parabolic concentrator. R. N. Singh, S. S. Mathur, and T. C. Kandpal (Indian Institute of Technology, New Delhi, India). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 393-395.

The consequences of using a fin collector in focusing solar collectors is examined and attention is given to the variation of concentration ratios for a cylindrical parabolic concentration employing a fin receiver. The effect of rim angle variation on the receiver size in both the flat plate and fin receiver cases are examined. It is determined that the concentration ratio attains a maximum value at a rim angle of 90 deg, while the flat plate receiver obtains a maximum at half the inclination. C.F.W.

A80-10848 The photo-electrochemical production of C-C bonds from carbon dioxide. V. Guruswamy and J. O. Bockris (Texas A & M University, College Station, Tex.). *International Journal of Energy Research*, vol. 3, Oct.-Dec. 1979, p. 397-399. Research supported by the South Australian Energy Committee.

Using the experimental setup and procedure described in the present paper, it proved possible to use solar light to reduce CO₂ to C-C bonds, with electricity as a by-product. Competitive reduction of water was avoided by passing CO₂ into a cathode chamber containing a saturated solution of an aprotic solvent (DMF). It is seen that electrochemical photosynthesis should be justified if an efficiency of photoelectrochemical decomposition of somewhat more than 5 per cent would be attainable with solar light. V.P.

A80-10879 A comprehensive model for photovoltage generation at metal electrodes in contact with solutions of fluorescent dyes. T. I. Quickenden and G. K. Yim (Western Australia, University, Nedlands, Australia). *Journal of Physical Chemistry*, vol. 83, Oct. 18, 1979, p. 2796-2804. 30 refs.

A comprehensive model for the processes associated with the generation of photovoltages at metal electrodes in contact with fluorescent dye solutions is developed, and relationships between open-circuit photovoltage and irradiance are derived. The model takes into account intermolecular oxidation-reduction reactions in the bulk of the solution and at the electrode, electrochemical charge-transfer reactions, conversion of bulk species to surface species with or without the possibility of adsorption, direct photochemical pathways and photochemical side reactions. Steady-state analyses of the model, which are presented in full in an appendix separate from the present paper, lead to complicated relationships between open-circuit photovoltage, irradiance, the dark concentrations of various species and the various rate constants. The relationships are found to simplify to logarithmic relationships for cases of low photolytic concentration perturbation and open-circuit voltage, and linear relationships in cases of low irradiance. A.L.W.

A80-10944 Lignite fuel and power-plant availability. T. G. Woo (Stone and Webster Engineering Corp., Boston, Mass.). *IEEE Transactions on Reliability*, vol. R-28, Oct. 1979, p. 279-282. 13 refs.

The characteristics and handling of lignite fuel in lignite-fueled electric-generating plants are studied. Plant reliability problems associated with burning of Northern Great Plains (NGP) lignite are discussed along with information on present NGP lignite-fueled plants. Two plant arrangements are considered: a single boiler and turbine and a single boiler and two half-size boilers. Order-of-magnitude costs are compared to determine cost differentials between a 500 MW single-boiler plant and a 800 MW double-boiler plant using lignite and subbituminous coal. It is noted that lignite is inexpensive, abundant, and relatively easy to mine. V.T.

A80-11019 Unleaded gasoline shortages and fuel switching - The potential impact in Southern California. T. F. Heinsheimer, J. S. Nevitt, and M. A. Nazemi (South Coast Air Quality Management District, El Monte, Calif.). *Air Pollution Control Association, Journal*, vol. 29, Oct. 1979, p. 1064-1066. 5 refs.

The impact on ozone air quality of the use of leaded fuels in automobiles equipped with catalytic converters, due to a shortage of unleaded fuels, is assessed for Southern California. Results of statistical analyses of the percentage of catalyst-equipped cars forced to undergo catalyst deactivation as a result of three or more tankfuls of leaded gasoline in the event of unleaded gasoline shortfalls of various magnitudes are presented, as well as the maximum ozone concentrations expected as the result of the tenfold increase of reactive hydrocarbon emission from deactivated converters and the numbers of ozone episode days as a result. It is pointed out that even a 6% shortfall of unleaded gasoline supplies lasting for 44 weeks will deactivate 50% of automobile catalytic converters, leading to an increase in the maximum yearly ozone concentration in Southern California of from 0.40 to 0.50 ppm and a dramatic increase in the numbers of first, second and third stage health advisory episode days in the Los Angeles Basin. A.L.W.

A80-11140 A policy-sensitive model of technology assessment. R. S. Ahmad and A. N. Christakis (Battelle Columbus Laboratories, Washington, D.C.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-9, Sept. 1979, p. 450-458. 17 refs. Research supported by the Battelle Memorial Institute; U.S. Environmental Protection Agency Contract No. 68-02-2622.

Two approaches to technology assessment are examined and their implications for the actual conduct of technology assessment are briefly discussed. The epistemological differences between the approaches are studied and it is determined that the fundamental differences between the two lead to divergent conceptions of technology. The first approach is driven by the question 'how can society be organized to take full advantage of technology and to mitigate its adverse impacts', while the second one concerns itself with the question 'what does it mean to choose and deploy a certain technology'. The broader relationships between technology assessment, social change, and public policy making are reexamined and it is determined that the assessment of technologies entails sociopolitical choices since the two are both reciprocally linked. Attention is given to the linkage between technical-analytic and policy-analytic components of technology assessment and a policy-sensitive model is proposed. C.F.W.

A80-11331 # Minimum ignition energies and quenching distances of methanol blends. T. Yano and K. Ito (Hokkaido University, Sapporo, Japan). *Hokkaido University, Faculty of Engineering, Bulletin*, June 1979, p. 31-37.

A study of minimum ignition energies and quenching distances for methanol, iso-octane, and iso-octane/methanol blends in the 100 to 150°C range and at 1 atm pressure is presented. Minimum ignition energies were measured with a conventional automobile ignition system and expressed by the primary current of the ignition coil, and the measurement methods of the quenching distances used the teflon-flanged electrode technique. The experimental results indicated that the minimal value of the minimum ignition energies, and the minimum quenching distances of methanol and iso-octane air mixtures were attained with a slightly rich mixture; the iso-octane/methanol blend yields larger flammability ranges than those of fuel in air. The quenching distances of iso-octane/methanol blend depend on that of iso-octane and do not become larger than that of either fuel. A.T.

A80-11333 The effects of axial conduction on collector heat removal factor. W. F. Phillips (Utah State University of Agriculture and Applied Science, Logan, Utah). *Solar Energy*, vol. 23, no. 3, 1979, p. 187-191. 9 refs.

A closed form solution is presented which predicts the performance of a solar collector and includes the effects of axial conduction in the receiver. The results are presented in terms of the

well known collector heat removal factor which is shown to be a function of three dimensionless design parameters. The error, which is introduced by neglecting axial conduction, was found to be less than 30 per cent, for all collectors and less than 12 per cent for most collectors. (Author)

A80-11334 Theory of the direct coupling between D.C. motors and photovoltaic solar arrays. J. A. Roger (Lyon I, Université, Lyons, France). *Solar Energy*, vol. 23, no. 3, 1979, p. 193-198. 5 refs.

Direct coupling between photovoltaic solar panels and various d.c. motors (series shunt and separate excitation) is theoretically studied as a function of the load. Operating curves are given in some specific cases (centrifugal pumps and fans). Attention is given to the problem of matching the mechanical system with the panels, and to the problem of starting under different light flux densities. (Author)

A80-11335 The optimal design of solar cell grid lines. R. S. Scharlack (Thermo Electron Corp., Waltham, Mass.). *Solar Energy*, vol. 23, no. 3, 1979, p. 199-201.

The shape of grid lines or fingers, used to reduce conductive losses in photovoltaic cells, is shown to be optimized when the current flux in the line remains constant. This result is derived for cells of arbitrary geometry assuming the fraction of the cell area shaded is small. The shapes of grid lines for three special cases are provided. Optimal shapes for grid lines are also derived for cases when the area of the lines is a significant fraction of the cell area. (Author)

A80-11336 Concentration ratio and efficiency in thermophotovoltaics. R. L. Bell (Varian Associates, Inc., Palo Alto, Calif.). *Solar Energy*, vol. 23, no. 3, 1979, p. 203-210.

In thermophotovoltaics, concentrated sunlight is used to heat a 'black body' cavity which re-emits lower-temperature radiation. Solar cells immersed in the cavity can absorb the higher energy photons present and convert these to electric power with high efficiency. A generalization of this scheme is considered as a model for calculating the conversion efficiency expected for a real thermophotovoltaic system. This is shown to depend strongly on the concentration ratio used, as well as other factors. It is shown that conversion efficiencies above 30 per cent will require optics concentration ratios of the order of 10,000, for attainable values of other parameters. Cell conversion efficiencies exceed 60 per cent; however system performance is strongly degraded by parasitic losses and by re-radiation from the entrance aperture of the system. (Author)

A80-11337 A theoretical study of laminar free convection in 1-D solar induced flows. O. A. Barra and E. P. Carratelli (Calabria, Università, Cosenza, Italy). *Solar Energy*, vol. 23, no. 3, 1979, p. 211-215. 11 refs.

The effectiveness of natural circulation and ventilation systems based on the 'solar chimneys' principle has been tested for a number of years at numerous sites, but thermal and fluid mechanical aspects of their operation need to be fully understood before conclusive results can be supplied; a long term research work has therefore been undertaken by the authors, including both experimentation in two test sites in Italy and numerical simulation. In the present paper the heat transfer equation for one dimensional laminar flow is numerically solved with the appropriate radiative boundary conditions. Temperature fields calculated in this way are then employed to evaluate air density variations and consequently the upward driving force available to overcome head losses in the air circulation. Optical plate spacing in steady state conditions appears to be strongly dependent on head losses occurring outside the collecting section and on winter or summer use of the system; it shows a softer dependence on incident solar energy fluxes. (Author)

A80-11338 Design of a small thermochemical receiver for solar thermal power. T. A. Chubb, J. J. Nemecek, and D. E. Simmons (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Solar Energy*, vol. 23, no. 3, 1979, p. 217-221. 5 refs.

It is noted that the capture of solar thermal energy by means of chemical conversion provides an attractive means for collection of solar energy. A converter has been designed for operation at the focus of a 7 m diameter paraboloid. The converter is constructed from a multi-passage ceramic extrusion, which is wound into a spiral form prior to firing. The innermost wrap is designed to operate with a cavity-facing surface heated to 1000 C. In the passages adjacent to this surface SO₃ is catalytically dissociated into SO₂ and O₂. The eight outer wraps are used for heat exchange between an inflowing SO₃ rich gas stream and an outflowing SO₂ rich gas stream. (Author)

A80-11339 Derivation of method for predicting long term average energy delivery of solar collectors. M. Collares-Pereira (Chicago, University, Chicago, Ill.) and A. Rabl. *Solar Energy*, vol. 23, no. 3, 1979, p. 223-233. 13 refs. Research supported by the Instituto Nacional de Investigação Científica and Centro de Física de Matéria Condensada; Contract No. EY-77-S-2446. DOE Task 3403,01.

Based on the utilizability concept of Hottle, Whillier, Liu and Jordan, an analytical model has been developed to predict the long term average energy delivery of almost any solar collector. The presentation has been split into two separate papers: a users guide (without explanation of the origin of the formulas) and the present paper (which derives these formulas and documents the validation). The model is applicable whenever the average operating temperature of the collector (receiver surface, fluid inlet, fluid outlet or mean fluid) is known. If the operating temperature is not known explicitly the model will give adequate results when combined with the f-chart of Klein and Beckman. By contrast to the alternative of hour-by-hour simulation, prediction methods such as the present model and the f-chart offer the advantages of automatically averaging over year-to-year weather fluctuations and of being sufficiently simple to permit hand calculation of long term performance. In a comparison with hourly summations of insolation data, the present model has been found to have an error of less than 3 per cent for the radiation available to a solar collector and an error of about 5 per cent for the heat delivery of solar thermal collectors. (Author)

A80-11340 Simple procedure for predicting long term average performance of nonconcentrating and of concentrating solar collectors. M. Collares-Pereira (Chicago, University, Chicago, Ill.) and A. Rabl. *Solar Energy*, vol. 23, no. 3, 1979, p. 235-253. 28 refs. Research supported by the U.S. Department of Energy, Instituto Nacional de Investigação Científica, and Centro de Física de Matéria Condensada.

The Liu and Jordan method of calculating long term performance of flat plate collectors (1963) is generalized to concentrating and nonconcentrating collectors. The collector is characterized by optical efficiency, heat loss, and extraction efficiency, and the tracking mode, and an operating temperature is assumed. A conversion factor is used which multiplies the total horizontal insolation to yield the long term useful energy delivered by the collector, and this factor depends on many variables including temperature, concentration, latitude, and clearness index. Formulas for flat plate, compound parabolic concentrator, and concentrators with east-west tracking axis, polar tracking axis, and 2-axis tracking showed that concentrating collectors can outperform the flat plate even for low temperature, cloudy climate applications. This method has been validated against hourly weather data showing better than 3 per cent accuracy for the long term average radiation. A.T.

A80-11341 Solar electric generating system resource requirements. R. C. Enger (U.S. Air Force Academy, Colorado Springs, Colo.) and H. Weichel (USAF, Institute of Technology, Wright-Patterson AFB, Ohio). *Solar Energy*, vol. 23, no. 3, 1979, p. 255-261. 16 refs.

The paper presents an analysis of the potential consumption of materials, land, water, manpower, energy, and money by four proposed solar electric generating systems: a terrestrial solar thermal, a terrestrial photovoltaic, an orbiting solar reflector, and a satellite solar power system. It is found that the terrestrial solar thermal system would require less manpower, less energy of production, and

less money per megawatt of electrical generating capacity, than would the extra-terrestrial systems. Finally, it is noted that an extra terrestrial system would place the nation in a vulnerable position in times of war.

M.E.P.

A80-11342 Some solar energy programmes in the United Nations system. B. Châtel (United Nations, Office for Science and Technology, New York, N.Y.). (*International Colloquium on Solar Energy for Development, Tokyo, Japan, Feb. 5-10, 1979.*) *Solar Energy*, vol. 23, no. 3, 1979, p. 263-269. 16 refs.

The recent activities in the United Nations organization on solar and wind energy, particularly for the developing countries, are outlined. Programs of the Economic and Social Council, Advisory Committee on Science and Technology, and the Committee on Natural Resources which worked on surveys and classification of non-conventional energy sources are described. The Economic Commission on Europe is engaged in environmental aspects of energy production, which also covers solar energy, and the Economic Commission for Africa participated in a mission on application of solar energy in the Sahelian region. The financial institutions include the U.N. Development Program which sponsored solar projects in Algeria and Cyprus, the World Bank, and the U.N. Industrial Development Organization. Finally, specialized agencies like UNESCO, which organizes international conferences on solar energy and research centers in Africa and Asia, World Health Organization, and World Meteorological Organization are discussed.

A.T.

A80-11343 A cheap method of improving the performance of roof type solar stills. V. A. Akinsete and C. U. Duru (Lagos, University, Lagos, Nigeria). *Solar Energy*, vol. 23, no. 3, 1979, p. 271, 272.

The paper presents the results of a test comparing the performance of two types of roof type solar stills. It is reported that the use of charcoal to line the basin of a typical still results in improved productivity. The charcoal is used to reduce the thermal inertia of the still, which is possible for the following reasons: (1) charcoal exhibits capillary action and is hence capable of maintaining a wetted surface whenever it is partially immersed in a liquid; (2) charcoal absorbs incident radiation, and (3) the rough surface scatters rather than reflects incident radiation which reduces reflected losses. In conclusion it is noted that the production rate is increased the most in the morning and on cloudy days when values of direct radiation are low.

M.E.P.

A80-11347 Nonlinear modification of resonance-cone trajectories. J. R. Wilson and K. L. Wong (Princeton University, Princeton, N.J.). *Physical Review Letters*, vol. 43, Nov. 5, 1979, p. 1392-1394. 12 refs. Contract No. EY-76-C-02-3073.

Experimental measurements of the modification of the trajectory of a focused resonance cone as a result of the ponderomotive force in a cylindrical plasma are reported. A resonance cone was launched from one ring of a 36-ring antenna located at one end of the plasma in 0.5- to 10 microsec rf bursts and axially and radially driven double-tip probes were used to detect the electric field. The locations of the electric field maximums for linear and nonlinear powers and of the focus indicate that trajectory is bent toward the cylinder axis and the focus is moved closer to the exciter, in agreement with theory. The electron-plasma-wave resonance-cone-propagation technique also indicates the decrease in plasma density to be in accordance with predictions and electron heating not to be the source of the trajectory shift.

A.L.W.

A80-11349 Tearing modes in a plasma with magnetic braiding. P. K. Kaw, E. J. Valeo, and P. H. Rutherford (Princeton University, Princeton, N.J.). *Physical Review Letters*, vol. 43, Nov. 5, 1979, p. 1398-1401. 14 refs. Contracts No. F44620-75-C-0037; No. EY-76-C-02-3073.

Linear and nonlinear properties of macroscopic tearing modes driven by anomalous electron viscosity effects associated with the

braiding of magnetic field lines in a tokamak plasma are examined. It is shown that in the linear case, tearing modes with $m=1$ have a growth rate which is proportional to the fifth root of the ratio between the hydrodynamic and viscous decay times, while in the nonlinear case for m greater than or equal to 2 the width of the instability scales as the cube root of the time. Implications for the growth times of viscosity-driven tearing modes relative to resistive modes and the development of disruptive instabilities in tokamak plasmas are considered.

A.L.W.

A80-11368 The semiconductor-insulator-semiconductor/indium tin oxide on silicon/solar cell - Characteristics and loss mechanisms. J. Shewchun, D. Burk, R. Singh, J. Dubow (McMaster University, Hamilton, Ontario, Canada; Brown University, Providence, R.I.; Colorado State University, Fort Collins, Colo.), and M. Spitzer. *Journal of Applied Physics*, vol. 50, Oct. 1979, p. 6524-6533. 12 refs. Contract No. E(04-3)-1203.

The theory of semiconductor-insulator-semiconductor (SIS) solar cells and the experimental characteristics of indium tin oxide (ITO)-SiO₂-silicon cells have been reported in previous publications. There appear to be no reports in the literature on SIS devices of any type with conversion efficiencies greater than about 12%. Theoretically, 20% efficiency should be possible using 0.2 ohm cm p-type silicon with a 12-A interfacial layer. This paper seeks to identify the various possible loss mechanisms (and the range of efficiency loss associated with each of them) that seem to be impeding the achievement of the theoretical limit. To determine the losses, the dark I-V characteristics as a function of temperature and performance parameters as a function of the intensity of illumination (up to 6 suns) have been examined. The intensity measurements reveal in a very distinct way the presence of an interfacial layer and serve to confirm the applicability of the theoretical model.

(Author)

A80-11369 Coal conversion technologies - Some health and environmental effects. S. C. Morris, P. D. Moskowitz, W. A. Sevan, L. D. Hamilton (Brookhaven National Laboratory, Upton, N.Y.), and S. Silberstein (National Bureau of Standards, Washington, D.C.). *Science*, vol. 206, Nov. 9, 1979, p. 654-662. 34 refs. Contract No. EY-76-C-02-0016.

Selected health and environmental effects of four coal conversion and four existing technologies are compared. For each technology, the emission estimates for complete fuel cycles, including all steps in fuel use from extraction to the end use of space and water heating by electricity or direct combustion, are discussed. Quantitative occupational health and safety estimates are presented for the extraction, transportation, distribution, processing, and conversion activities associated with each technology. Qualitative estimates of health damage due to polycyclic organic matter and reduced sulfur are examined. The increasing order of some negative environmental effects and health damages was determined to be: (1) direct combustion of natural gas and oil, (2) direct combustion of synthetic gas and oil, (3) central-station electric power produced from synthetic gas, coal, and combustion of synthetic liquid fuels. Attention is given to the compliance and conflict of these technologies with amendments such as the Clean Air Act.

C.F.W.

A80-11370 Solar availability for winter space heating - An analysis of SOLMET data, 1953 to 1975. J. G. Asbury, C. Maslowski, and R. O. Mueller (Argonne National Laboratory, Argonne, Ill.). *Science*, vol. 206, Nov. 9, 1979, p. 679-681. 8 refs. Research supported by the U.S. Department of Energy.

Solar availability for space heating on coldest-weather days has been determined from an analysis of SOLMET data tapes. The tapes contain hourly readings of insolation and ambient temperature over the period from 1953 through 1975. Scatter diagrams of insolation versus heating degree-days, compiled on a daily basis, indicate a wide variation in the insolation level, even during coldest-weather periods. For all but one of the eight sites studied, the peak-day backup energy requirement of the solar system was in excess of 85 percent of the peak-day energy requirement of the conventional (nonsolar) heating system.

(Author)

A80-11394 # Is there a chance for OTEC. G. L. Dugger (Johns Hopkins University, Laurel, Md.). *Astronautics and Aeronautics*, vol. 17, Nov. 1979, p. 36-42. 20 refs.

The paper discusses the steady growth of OTEC technology, the design plans for pilot energy plants, and the industrial readiness for this alternate energy source. Several new components are examined that will enhance and speed up OTEC implementation, including a 30 Mw set of titanium-tubed, shell-and-tube heat exchangers, a low-cost, folded-aluminum tube, shell-less heat exchanger, as well as designs for cold-water pipe 40Mw pilot plants. It is concluded that OTEC offers great potential for significant contributions to national and worldwide energy needs. C.F.W.

A80-11400 Soft and hard energy paths - The roads not taken. M. Stiefel. *Technology Review*, vol. 82, Oct. 1979, p. 56-66. 27 refs.

The paper considers political, technical, and philosophical aspects of the energy problem. The 'hard' energy path which relies on the continued expansion of centralized technologies to increase energy supply, will use oil, coal, and nuclear fission. The 'soft' path technologies use renewable energy flows, such as from the sun or wind, and require solar collectors, hydroelectric plants and wind for electric power. Cost estimates of energy technologies including nuclear power, coal and solar are discussed, and energy demand forecasts for U.S. are summarized. Comparison of hard and soft options indicates that the hard-path will collapse due to massive energy waste, but a single energy path is not likely. A.T.

A80-11448 Analysis of tarry fractions in emissions resulting from low temperature oxidation of brown coal (Analyse der hochsiedenden Emissionsanteile von Schmelzen und Bränden bei der Gewinnung von Braunkohle). V. Kusy and V. Hruby. *Staub - Reinhaltung der Luft*, vol. 39, Oct. 1979, p. 363-367. 24 refs. In German.

The gas chromatography as a basic method for tarry emission fractions from the low-temperature oxidation of brown coal has been used. Besides of paraffines C9 till C27, phenol, cresols and xylenols also heterocyclic oxigenous compounds have been determined by the combination of the preparation and analytic gas chromatography. Very little multinucleous aromatic hydrocarbons were present. The quantitative determination of the components has been made from the differences of the retention indexes on the polar and non-polar stationary phase. (Author)

A80-11544 # Effect of kinetics of thermonuclear reaction products upon D-T plasma parameters. K. Gac, A. Gacek, J. Tyl (Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland), and S. Kaliski. *Journal of Technical Physics*, vol. 20, no. 2, 1979, p. 131-149. 8 refs.

The paper analyzes the effects of the kinetics of fusion products on the hydrodynamic parameters of the plasma. Different transport models for the fusion products are considered, and it is shown that neutron kinetics has a significant effect on fusion energy even for small-scale systems. Attention is also given to the role of such factors as dynamic friction forces, the method of fusion energy transmission, and the amount of neutron energy remaining in the plasma. B.J.

A80-11545 # Optimization of neutron yield in conical system at explosion-induced compression. W. Gluchowski, R. Swierczynski (Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland), and S. Kaliski. *Journal of Technical Physics*, vol. 20, no. 2, 1979, p. 151-162. 9 refs.

The paper presents a numerical optimization analysis of neutron yield for a conical fusion system involving explosive plasma compression. The initial pressure of deuterium gas and the thickness of the imploded polyethylene shell were the parameters subject to optimization. An optimal yield of 7×10 to the 7th neutrons was obtained for deuterium, while a yield of 5×10 to the 9th neutrons was obtained for D-T. B.J.

A80-11546 # Optimization of argon admixture in deuterium fusion with non-stationary action of plane shock waves. K. Gac, K.

Jach, W. Stepniewski (Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland), and S. Kaliski. *Journal of Technical Physics*, vol. 20, no. 2, 1979, p. 163-171. 7 refs.

The paper presents a numerical analysis of the complete system of equations of hydrodynamics and ionization kinetics describing the propagation of shock waves in a deuterium-argon mixture. It is shown that maximum temperatures are obtained in this shock compression process (in the case of constant boundary velocity and plane symmetry) for argon additions of approximately 4%. B.J.

A80-11612 Kinetics of the processes in a plasma produced by an electron beam in a dense inert gas. A. V. Eletskii and V. D. Kulagin (Akademii Nauk SSSR Institut Atomnoi Energii, Moscow, USSR). (*Fizika Plazmy*, vol. 5, Jan.-Feb. 1979, p. 98-105.) *Soviet Journal of Plasma Physics*, vol. 5, Jan.-Feb. 1979, p. 55-59. 9 refs. Translation.

In the present paper, the conversion of the energy imparted by a beam to a gas is quantitatively analyzed, and the parameters of the quasi-stationary plasma generated in this process are calculated. The contribution of elastic and inelastic electron-atom collisions and free-electron production processes to the electron energy balance is calculated. V.P.

A80-11642 # Performance of disk generators for open-cycle MHD power generation. T. Nakamura and M. K. Jenkins (Stanford University, Stanford, Calif.). *Journal of Energy*, vol. 3, July-Aug. 1979, p. 217-226. 28 refs. Contract No. EX-76-C-2341.

The performance characteristics of disk MHD generators are analyzed for the combustion products of a western coal at typical baseload conditions. Three disk generator configurations - radial outflow, radial inflow, and radial inflow-outflow - are considered for both impulse and reaction modes of operation. It is shown that for enthalpy extraction, generator isentropic efficiency, and electric fields to be sustained along the generator channel and the reaction mode radial inflow configuration is preferable for the baseload disk generator. The radial inflow-outflow configuration, which is a combination of the inflow and outflow geometries, could attain higher performance than the radial inflow configuration with substantially reduced generator size. Comparisons of disk generators with linear generators show that the performance of the disk generator is comparable to that of the diagonal generator, while the magnet cost for the disk generator is expected to be less than for linear generators. In view of these results, together with the advantages associated with simple channel construction, it is concluded that the disk generator is a potentially effective alternative to linear generators for baseload power generations. (Author)

A80-11643 # Experimental demonstration of the diffuser-augmented wind turbine concept. B. L. Gilbert and K. M. Foreman (Grumman Aerospace Corp., Fluid Dynamics Laboratory, Bethpage, N.Y.). *Journal of Energy*, vol. 3, July-Aug. 1979, p. 235-240. 5 refs. Contract No. EY-76-C-2-2616-A001.

The surface area requirements of an efficient diffuser has been reduced by innovative use of the external wind to produce a cost-effective wind energy conversion system (WECS). Three sets of tests were conducted on very compact diffusers: 1) on small-scale models using screens to simulate a real turbine; 2) on ten times larger scale models with screens; and 3) on a real turbine. The first-generation nonoptimized diffuser-augmented wind turbine (DAWT) configuration is a conical, 60 deg included angle diffuser with an area ratio of 2.78 controlled by two tangential injection slots for boundary-layer control. This baseline model provided over three times the power of a conventional WECS with the same turbine efficiency, diameter, and free wind. An optimized configuration should provide augmentations greater than four. (Author)

A80-11644 # Electricity generation from jet-stream winds. C. A. J. Fletcher and B. W. Roberts (Sydney, University, Sydney, Australia). *Journal of Energy*, vol. 3, July-Aug. 1979, p. 241-249. 12 refs. Research supported by the National Energy Research, Development, and Demonstration Council of Australia.

The feasibility of generating electricity from jet-stream winds has been investigated. Analysis of published meteorological data indicates that annual average power densities approaching 20 kW/sq m are available in the jet-stream altitudes over the complete west-east extent of Australia at a latitude of about 30 deg S. Computer-based optimization studies indicate that a 100-MW power station based on tethered aerodynamic generating platforms located at a jet-stream altitude would generate electricity at capital and operating costs that are competitive with other methods of electricity generation. The design of the tethered aerodynamic generating platform requires a high lift-to-weight ratio platform housing high power-to-weight ratio diffuser-augmented wind turbines and tethered by a high strength-to-weight ratio cable. Key design parameters include the turbine power coefficient and power-drag coefficient, the rated speed, and the stall speed. The required turbine area is determined primarily by the power coefficient and the rated speed. The cable weight depends directly on the drag associated with the maximum (rated) power generation which follows from the choice of rated speed. The wing area of the aerodynamic platform is fixed usually by the stall speed. (Author)

A80-11645 # The pedal wind turbine. T. Vinayalingam (West Indies, University, St. Augustine, Trinidad and Tobago). *Journal of Energy*, vol. 3, July-Aug. 1979, p. 254-256.

A vertical-axis, resistance-type turbine has been developed for wind energy utilization in developing nations. The device employs cycling of the rectangular turbine sail at different orientations to the wind to ensure smooth operation, and resembles a bicycle pedal. Theoretical analysis of the quasi-steady performance of the turbine indicates that a two-sail version of the pedal turbine will exhibit more uniform torque characteristics than the two-bucket Savonius rotor, thus reducing the stalling problem, and will have a peak power coefficient of 0.13. Higher efficiencies are anticipated with a slack sail which assumes a bucket shape under wind pressure, and wind-tunnel tests of a scale model are in progress. A.L.W.

A80-11671 # Improving the reliability of capacitance batteries in power grids with higher-harmonic sources (Povyshenie nadezhnosti kondensatsionnykh batarei v setiakh s istochnikami vysshikh harmonik). A. N. Bokhan (Belorusskii Politehnicheskii Institut, Minsk, Belorussian SSR). *Energetika*, vol. 22, Aug. 1979, p. 87-89. 5 refs. In Russian.

A80-11709 # Interactive analysis methods for resource mapping. A. K. Turner (Environment Consultants, Inc., Lakewood, Colo.). In: *New technology for mapping: Proceedings of the International Symposium*, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 735-754. 6 refs.

An interactive composite mapping system called GMAPS (General Map Analysis and Planning System), has been used to evaluate energy development plans, and make resource and environmental assessments. GMAPS is superior to the traditional transparent overlay methods because it is much cheaper, faster and more quantitative. Using GMAPS, variables and interactions can be easily modified to rapidly investigate an unlimited range of development alternatives. An associated mapping system GCARS, (Generalized Computer Aided Route Selection), can generate a set of alternative corridors between specified termini by applying linear programming methods to GMAPS models. The corridors are ranked for suitability according to environmental and socio-economic criteria. (Author)

A80-11816 Flame propagation through unconfined and confined hemispherical stratified gaseous mixtures. P. Girard, M. Huneau, C. Rabasse, and J. C. Leyer (Ecole Nationale Supérieure de Mécanique et d'Aérotechnique, Poitiers, France). In: *Symposium /International/ on Combustion*, 17th, Leeds, England, August 20-25, 1978, Proceedings. Pittsburgh, Pa., Combustion Institute, 1979, p. 1247-1255. 20 refs. Research supported by the Commissariat à l'Energie Atomique, Electricité de France, and Institut de Recherche sur les Transports.

To observe nonsteady flame propagation across gaseous mixtures of nonuniform composition, a technique based on an improvement of the soap bubble method is proposed. Two applications of the method are presented. The first refers to constant volume combustion and is designed to model flame propagation in the cylinder of a stratified charge internal combustion engine where a hemispherical rich charge surrounds the ignition point. Effects of stratification on the final pressure and combustion time are reported for hydrogen and propane-air mixtures. The second application concerns flame propagation in free space, through layered hemispherical charges. Results which relate mainly to the correlation between the generated pressure field and the flame front velocity variations induced by concentration steps are used to describe some of the effects of nonuniform composition on the blast effects of actual vapor cloud explosions. (Author)

A80-11825 # Solar panels exposed to cosmic rays (Solnechnye batarei v usloviakh vozdeistviia kosmicheskoi radiatsii). L. B. Kreinin and G. M. Grigor'eva. *Itogi Nauki i Tekhniki, Seriya Issledovanie Kosmicheskogo Prostranstva*, vol. 13, 1979, p. 3, 5-128. 232 ref. In Russian.

Data on radiation damage of solar cells are reviewed, and the mechanisms of damage by electrons and protons are discussed. The topics covered include the influence of the orbital parameters on the rate of solar panel degradation; methods of shielding spacecraft panels, and methods of improving the resistance of solar panels to cosmic rays. V.P.

A80-11826 Annual review of energy. Volume 4. Edited by J. M. Hollander (California, University, Berkeley, Calif.), M. K. Simmons (Solar Energy Research Institute, Golden, Colo.), and D. O. Wood (MIT, Cambridge, Mass.). Palo Alto, Calif., Annual Reviews, Inc., 1979. 567 p. \$17.

An overview of the CONAES study is presented along with reviews of several major energy supply resources and technologies, including the global uranium resource, the North Sea oil field, U.S. coal production, photochemical conversion of solar energy, and the interfacing of solar wind systems with electric grids. Topics related to energy economics and econometrics include three assessments of energy supply-demand models and projections, and a discussion of issues in the design of utility rate structures. Energy end-use is represented by a review of possible impacts of telecommunications on energy consumption. International policy-related reviews cover energy situation of Canada and the question of international assurance of nuclear fuel supply. B.J.

A80-11827 United States energy alternatives to 2010 and beyond - The CONAES study. H. Brooks (Harvard University, Cambridge, Mass.) and J. M. Hollander (California, University, Berkeley, Calif.). In: *Annual review of energy. Volume 4.*

Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 1-70. 56 refs.

The CONAES (Committee on Nuclear and Alternative Energy Systems) study examined contextual relationships among the many factors likely to be involved in determining United States energy policy, and, in particular, emphasized the importance of energy demand considerations in planning future U.S. energy supplies. It is concluded that there is a great deal of scope for reducing energy growth without appreciably sacrificing GNP growth or changing nonenergy consumption patterns. Although there is some uncertainty in this conclusion, it is likely that E/GNP one half of today's and conceivably one third of today's could be reached before significant impact on GNP growth is felt. It is recommended that reduction of energy demand growth be accorded the highest priority in United States energy policy. B.J.

A80-11828 The compatibility of wind and solar technology with conventional energy systems. E. Kahn (California, University, Berkeley, Calif.). In: *Annual review of energy. Volume 4.* Palo Alto, Calif., Annual Reviews, Inc., 1979, p.

313-352. 102 refs. Research supported by the U.S. Department of Energy.

A wide range of issues in the engineering and economics of wind and solar energy is reviewed. It is concluded that the various effects of introducing these devices into conventional energy systems are only partially understood; the present analytical tools are rather limited in their ability to grasp the total problem. In the short run, engineering issues involving resource assessment and appropriate scale seem particularly important. The more complex problems of structural optimality in energy systems emerge only in a longer-range perspective. Economic analysis should probably concentrate first on financial risk. Regulatory structure is an on-going area where policy research is fruitful. B.J.

A80-11829 Photochemical conversion and storage of solar energy. J. R. Bolton (Western Ontario, University, London, Canada) and D. O. Hall (King's College, London, England). In: Annual review of energy. Volume 4. Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 353-401. 190 refs. Research supported by the Natural Sciences and Engineering Research Council of Canada.

Following a review of some of the general principles and limitations of the conversion of light energy to work, the paper examines in detail the only process that operates reliably and with an appreciable conversion efficiency, namely photosynthesis by plants, algae, and bacteria. These systems already produce 3 times 10 to the 21st J of stored energy per annum (which is 10 times the world's annual energy use). Attention is given to some of the ways in which photosynthesis can be mimicked and extended to produce other products such as hydrogen, reduced carbon compounds, ammonia, as well as electricity. Development of artificial systems for the photochemical conversion and storage of solar energy is critically examined. Both homogeneous and heterogeneous systems are considered, the latter involving valuable developments in photoelectrochemistry. Finally, an attempt is made to answer some economic questions relevant to some applications. S.D.

A80-11830 Frontiers in energy demand modeling. R. S. Hartman (Boston University, Boston; MIT, Cambridge, Mass.). In: Annual review of energy. Volume 4. Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 433-466. 110 refs.

The paper introduces and critiques a series of energy demand models and explores the particularly promising directions for future energy demand modeling. Some detailed suggestions for advancing the frontiers of energy demand modeling are made. Important issues addressed by frontier energy demand modeling efforts include: (1) explicit analytical treatment of both long-run and short-run demand, for the purpose of identifying behavioral characteristics and policy variables specifically relevant to each; (2) appropriate level of disaggregation of energy end-use, for the purpose of permitting technological specificity in treating fuels and the fuel-burning capital stock; (3) appropriate treatment of new technologies; and (4) utilization of appropriate models and data for residential consumer choice and for dynamic modeling of industrial and commercial demand. B.J.

A80-11831 Assessing energy policy models - Current state and future directions. M. Greenberger (Johns Hopkins University, Baltimore, Md.) and R. Richels (Electric Power Research Institute, Palo Alto, Calif.). In: Annual review of energy. Volume 4. Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 467-500. 41 refs.

The paper presents a brief review of the energy policy modeling process and considers two kinds of model analysis (i.e., analysis focusing primarily on the model and analysis focusing more on policy issues and uses of the model). A two-way classification scheme for model analyses is presented, and examples of analysis by model developers, model users, third-party model analysts, and joint efforts, are given. This is followed by an examination of the nature of independent assessment, and a description of an experiment in model assessment, i.e., the MIT assessment of the Baughman-Joskow Regional Electricity Model. B.J.

A80-11832 Review of scenarios of future U.S. energy use. J. Just (Donovan, Hamester and Rattien, Inc., Washington, D.C.) and L. Lave (Carnegie-Mellon University, Pittsburgh, Pa.). In: Annual review of energy. Volume 4. Palo Alto, Calif., Annual Reviews, Inc., 1979, p. 501-536. 41 refs.

The following energy scenarios are reviewed: (1) CINAES Integration Scenario (1976-1977); (2) Modeling Resource Group (1976-1977); (3) the Energy Policy Project (1974); (4) Workshop on Alternative Energy Strategies (1977); (5) Nuclear Energy Policy Study Group; (6) Project Independence; (7) Energy Information Administration's Annual Report (1977); (8) National Energy Plan (1977); (9) ERDA National Energy R&D Plan (1975); (10) Market Oriented Program Planning Study (1977); and (11) Inexhaustible Energy Resources Planning Study (1977). Emphasis in this assessment is placed on the limitations of the scenario method, whether assisted by formal or purely judgmental models. It is concluded that the strength of the scenario method will continue to depend more upon the richness of the set of alternative futures considered than upon the quality of any single projection. B.J.

A80-11837 Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. Symposium sponsored by the Joint Services Electrical Power Sources Committee. Edited by J. Thompson (Royal Aircraft Establishment, Farnborough, Hants., England). London, Academic Press, Inc. (London), Ltd., 1979. 786 p. \$134.

A collection of papers is presented regarding recent advances in the research and development of nonmechanical electrical power sources. Attention is given to many types of primary, secondary, high-temperature and reserve batteries, along with fuel cells and other types of nonmechanical power sources. Topics of interest include some promising aspects regarding solar energy conversion with metal oxide photovoltaic cells, recent advances in zinc-bromine batteries, hydrogen (hydride) air secondary battery, a new metal/plastic compound electrode for traction batteries, and lead-lead dioxide perchloric acid reserve cells. S.D.

A80-11838 Cadmium electrodes with improved surface characteristics for alkaline storage batteries. S. Sathyanarayana (Indian Institute of Science, Bangalore; Tamil Nadu Alkaline Batteries, Ltd., Madras, India). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 141-149; Discussion, p. 149-151. 5 refs.

It is shown that minute crystallites of active material which usually cover the exterior surface of sintered plate cadmium electrodes may be rendered electrochemically inactive by electrodepositing a thin layer of pure nickel on them. The charge-discharge reactions of the cadmium electrode occurring inside the porous matrix are not affected by this process. The stability of the cadmium electrode with regard to cycle life and possibly ageing, is enhanced due to a decreased density of nucleation sites for the formation and growth of cadmium dendrites on the exterior surface of the electrode. There is no hydrogen evolution during overcharge of sealed nickel-cadmium cells with such flash-nickel plated negative electrodes under normal conditions so long as the capacity of the cell is limited by that of the positive electrode. The oxygen recombination rate following overcharge is, surprisingly, enhanced by the above process of flash nickel-plating to a significant extent. (Author)

A80-11839 Non-sintered plastic-bonded nickel oxide electrodes with open structure and their electrochemical performance. J. Mrha, I. Krejci, B. Klapste (Ceskoslovenska Akademie Ved, Ustav Fyzikalni Chemie a Elektrochemie, Prague, Czechoslovakia), B. Braunstein (Statni Vyzkumny Ustav Materialy, Prague, Czechoslovakia), V. Koudelka, and J. Malik (Prazska Akumulatorka, Mlada Boleslav, Czechoslovakia). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings

of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 153-170. 12 refs.

Conductive plastic enables an elastic and simultaneously electronic conductive connection between the particles of the active material used in pocket-type nickel oxide electrodes to be made. The mixture of these materials can be rolled after the addition of a liquid milling agent onto a metallic grid at room temperature. An electrode thus formed, pressed to 120 MPa gives more than 1000 cycles during accelerated life testing. At discharge rates greater than 1C (C = capacity) the electrochemical performance is controlled by the quality of the joining area of the active mass-collector and correlation of this performance with the results of impedance measurements is found. (Author)

A80-11840 Failure mechanisms of vented nickel-cadmium cells in overcharge. K. L. Dick, T. Dickinson (Newcastle-upon-Tyne, University, Newcastle-upon-Tyne, England), R. J. Doran, S. E. A. Pomroy, and J. Thompson (Royal Aircraft Establishment, Materials Dept., Farnborough, Hants., England). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 195-216; Discussion, p. 217, 218. 7 refs.

The observed overcharge characteristic of defective vented nickel-cadmium cells has been investigated in terms of three possible failure mechanisms, namely, oxygen recombination, the operation of redox systems and the formation of 'soft' shorts. Experiments have included electrochemical studies at stationary and rotating disc cadmium electrodes, voltammetry in cell electrolyte, characteristics of defective and specially constructed vented cells and the examination of cell components by scanning electron microscopy. Results indicate that all three mechanisms can carry current in overcharge to varying extents but that the formation of soft shorts appears to be critical in producing the defective behavior frequently observed. (Author)

A80-11841 Improvement of the high-rate discharge behaviour of the nickel electrode. G. Crespy, R. Schmitt (Battelle, Centre de Recherche de Genève, Geneva, Switzerland), M. A. Gutjahr, and H. Säufferer (Daimler-Benz AG, Stuttgart, West Germany). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 219-236; Discussion, p. 237. 14 refs. Research sponsored by the Daimler-Benz AG.

The energy density and the high-rate discharge behavior of alkaline batteries (Cd/Ni, Fe/Ni, Zn/Ni, TiNi/Ni) can be increased by structural improvements of the positive nickel electrode. A highly porous nickel-foam structure has been developed, applying a one-step sintering technique. Porosities of 85 percent and more can be achieved without diminution of the mechanical strength. The use of this structure as support in nickel electrodes allows an increase of the specific capacity and an improvement of the high-rate discharge behavior at different temperatures. The overall electrochemical characteristics of these electrodes are superior to that of conventional sintered electrodes which make them particularly well adapted for alkaline traction batteries. (Author)

A80-11842 High-efficiency alkaline accumulator with cadmium mass treated with oxalic acid. J. Sander, M. Cenek, A. Touskova, M. Calabek (Brno, Vysoke Ucení Technické, Brno, Czechoslovakia), J. Mrha, and J. Jindra (Ceskoslovenska Akademie Ved, Ustav Fyzikální Chemie a Elektrochemie, Prague, Czechoslovakia). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 239-247. 5 refs.

With the use of oxalic acid as modifying additive to active cadmium mass for alkaline accumulators it is possible to increase its efficiency of utilization by 10-20% due to the increase in porosity and specific active surface and to improve the accumulator output and low-temperature parameters. The results of the positive effect of oxalic acid have been demonstrated by evaluating the electrical parameters of nickel-cadmium accumulators during cycling. (Author)

A80-11843 Development of silver-hydrogen cells. G. L. Holleck, M. J. Turchan, F. S. Shuker, D. J. DeBicari, and P. O. Offenhardt (EIC Corp., Newton, Mass.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 271-283; Discussion, p. 283, 284. Contract No. F33615-76-C-2093.

With a projected energy density of close to 80 Wh/kg and a cycle life of about 1000 cycles, silver-hydrogen cells represent a promising power source for specialized applications. Electrolyte management is the main problem area. Unfavorable electrolyte transport properties make common argentatistic membranes such as Visking and grafted polyethylene films not suitable for Ag/H₂ cells. Attractive Ag/H₂ cells can be constructed with an inorganic-organic separator developed by NASA. (Author)

A80-11844 Development of silver-hydrogen cells. P. Antoine and P. Fougere (Société des Accumulateurs Fixes et de Traction, Romainville, Seine-Saint-Denis, France). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 285-299; Discussion, p. 299, 300. Research supported by the European Space Agency and Direction des Recherches, Etudes et Techniques.

Metal-hydrogen systems have been intensively studied for several years because of their high energy density. A Ag-H₂ couple, recently developed, offers an energy density of about 80-100 Wh/kg which is 70 percent higher than the energy density of the Ni-H₂ couple. The physicochemical phenomena which can lead to the life-time limitation of the Ag-H₂ system are under investigation. Different methods for improving the cycle life to Ag-H₂ cells and first results already obtained are presented. Interesting characteristics of Ag-H₂ cells have been obtained particularly during overcharge and charge retention tests. To date, several Ag-H₂ cells have undergone 24-h cycle tests at 22 C and 50 percent depth of discharge. 300 cycles have already been achieved. Other cells on a 100-minute cycle test at 22 C and 27 percent depth of discharge have already reached 3000 cycles. (Author)

A80-11845 Zinc-bromine battery studies. R. J. Bellows, D. J. Eustace, P. Grimes, J. A. Shropshire, H. C. Tsien, and A. F. Venero (Exxon Advanced Energy Systems Laboratory, Linden, N.J.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 301-311; Discussion, p. 311, 312. 14 refs.

Studies on a circulating-electrolyte zinc-bromine battery are described. Used in conjunction with low-cost conductive plastic electrodes and separable bromine complexes, the system provides efficient operation at energy-density levels attractive for traction as well as energy storage use. Performance of the system is described, including evaluation of the cycling behavior of monopolar and bipolar modules. Projections of energy densities and possible cost ranges are made. (Author)

A80-11846 Recent advances in zinc-bromine batteries. F. G. Will (General Electric Co., Schenectady, N.Y.). In: Power sources 7: Research and development in non-mechanical electrical power

sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 313-326; Discussion, p. 326-328. 11 refs. Contract No. EY-76-C-02-2950.

The design and performance of zinc-bromine cells which employ all-carbon electrodes, a stable cation exchange membrane and electrolyte circulation is described. The design permits internal electrolyte manifolding and stacking of cells in electrical series, using bipolar electrodes. Individual cells of this type have been charged and discharged with 3.1 A or 25 mA/sq cm for four and eight hours each, corresponding to an energy delivered of up to 36 Wh. Constant performance has been demonstrated for an 18 Wh cell in 170 cycles for a total of 1200 h while attaining a coulombic efficiency of 96%, volt-efficiency of 76% and electrochemical energy efficiency of 73%. (Author)

A80-11847 Optimization of iron-air and nickel oxide-iron traction batteries. B. Andersson and L. Ojefors (Swedish National Development Co., Dept. for Energy and Environmental Technology, Akersberga, Sweden). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 329-342; Discussion, p. 342, 343. 5 refs.

An analysis is carried out to determine how different factors contribute to the decrease in energy density from the theoretical values of 760 and 265 Wh per kg to the real values. For the iron-air battery, a full scale 30 kW h system with 80 kWh per kg is considered and for the nickel-oxide concept a 300 Ah cell with 55.5 Wh per kg. It is reported that the analysis shows the possibility of increasing the energy densities to 105 Wh per kg (advanced) for the nickel oxide iron system. It is concluded that the tests carried out with these two alkaline battery systems and the calculations made, show that they will be competitive power sources for traction applications in the near future. M.E.P.

A80-11848 Hydrogen /Hydride-air secondary battery. J. Sarradin, G. Bronoel (CNRS, Grenoble, France), A. Percheron-Guegan, and J. C. Achard (CNRS, Meudon, Hauts-de-Seine, France). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 345-350; Discussion, p. 350, 351. 11 refs. Research supported by the Direction des Recherches, Etudes et Techniques.

The use of metal hydrides as negative electrodes in a hydrogen-air secondary battery seems promising. However, in an unpressurized cell, more stable hydrides than LaNi_5H_6 must be selected. Partial substitutions of nickel by aluminium or manganese increase the stability of hydrides. Combined with an air reversible electrode, a specific energy close to 100 Wh/kg can be expected. (Author)

A80-11849 Neutral electrolyte aluminium-air battery. D. M. Drazic, A. R. Despic, S. Zecevic, M. Atanackovic (Beograd, Univerzitet; ICTM, Institute of Electrochemistry, Belgrade, Yugoslavia), and I. Iliev (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Elektrokhimichni Iztochnitsi na Tok, Sofia, Bulgaria). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 353-362; Discussion, p. 362, 363. 5 refs.

A neutral electrolyte, aluminum-air battery, using an active aluminum-alloy anode and an active carbon-based air electrode is described. Attention is given to the development of the battery noting that problems with electrolyte gelling which resulted in reduced operation of the battery were overcome by adding NaF to the electrolyte and by seeding with aluminum oxide powder. It is calculated that energy from the Al-air system should be three times cheaper than that of the Zn-air and 2.8 times cheaper than that of

the Mg-air system. Finally, it is claimed that it is ecologically superior to any battery system known to date, in that it is harmless, nonpolluting and acceptable to almost any environment. M.E.P.

A80-11850 The conversion of ethylene glycol with air in alkaline fuel cells. H. Cnobloch, D. Gröppel, H. Kohlmüller, D. Kühl, and G. Siemsen (Siemens AG, Forschungslaboratorien, Erlangen, West Germany). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 389-403; Discussion, p. 403, 404. 13 refs.

Because of their easy storage and high charge density, liquid fuels are studied for use in fuel cells. The relatively cheap and industrially produced ethylene glycol can theoretically yield 428 Ah per liter during conversion to the stage of glycolic acid. A noble metal catalyst stabilized with bismuth and consisting of 43%Pt, 34%Pd, and 23%Bi has proved particularly useful for the oxidation of glycol. The reduction of air-oxygen takes place at hydrophobic carbon electrodes which contain silver as the catalyst. A 12-cell 50 W battery with a capacity of 77 Ah has performed well in a continuous service test. (Author)

A80-11851 The performance of molten-carbonate fuel cells. K. F. Blurton, L. G. Marianowski, and E. H. Camara (Institute of Gas Technology, Chicago, Ill.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 405-417; Discussion, p. 417, 418. ERDA Contract No. 31-109-38-3552.

Molten-carbonate fuel cells are potential high-efficiency power sources for the 1980s. At that time, we will be required to operate on a variety of fuels, thus this study was undertaken to determine the effect of fuel cell feedstock and other major operating parameters. Results are shown for the operation of the fuel cell on gases simulating those processed by common techniques from methane, naphtha, heavy fuel oils, and coal. The relationship between fuel quality and the fuel cell performance, and the effect of oxidant composition, fuel and oxidant utilization, and cell temperature are also described. (Author)

A80-11852 Utility fuel cells for Sweden. O. Lindstrom, T. Nilsson, M. Bursell, C. Hornell, G. Karlsson, C. Sylvan, and B. Ahgren (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 419-434; Discussion, p. 435, 436. 18 refs. Research supported by the National Swedish Board for Energy Source Development, Styrelsen for Teknisk Utveckling, and Carl Trygger's Foundation for Scientific Research.

A modest program for useful fuel cell systems is under way in Sweden. The concept is composed of a fuel processor (for conversion of biomass and peat to hydrogen) and alkaline fuel cells. The fuel processor uses a modified steam-iron process with a high conversion efficiency. Most of the experimental work is concerned with the development of electrode materials; cathodes consisting of nickel screens embedded in PTFE bonded silver catalysts give 1 kA/sq m in the range -0.11 to -0.21 V vs. Hg/HgO; anodes with skeleton-nickel from AlNiTiMo alloys on nickel matrixes have given 1 kA/sq m at -0.87 V vs. Hg/HgO at best. Various cell and module designs are being evaluated for use in a theoretical 100 MW plant. One idea, using so-called FC-041 2.5 MW generator units, seems to be quite competitive in cost. (Author)

A80-11853 Some promising aspects regarding solar energy conversion with metal oxide photovoltaic cells. F. T. Tanasescu, C. I. Popescu, and D. Moraru (Institutul de Cercetari si Proiectari pentru Industria Electrotehnica, Bucharest, Rumania). In: Power sources 7: Research and development in non-mechanical electrical power

sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 437-444. 10 refs.

The paper presents a photoconverter with an Al/Cu₂O/Cu structure, where the photovoltaic junction is Al/Cu₂O; the Cu₂O/Cu junction produces an electric field contributing to an increase in both the collection efficiency of the generated carriers and consequently in the conversion efficiency. The improvement of this type of converter for which the specialized literature mentions an efficiency approximately equal to 1%, may be a good solution for a large scale energy conversion in the future due to its real possibilities of development. (Author)

A80-11854 Studies on the Ca-CaCrO₄ and Li-Al-FeS₂ systems for thermal battery applications. P. V. Dand, K. K. Press, and G. R. Wisniewski (KDISCORE, Inc., Cockeysville, Md.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 501-517; Discussion, p. 517, 518. 7 refs. USAF-supported research.

The need for a long life thermal battery has spurred efforts at evaluating new electrochemical couples for potential replacement of the Ca-CaCrO₄ system. This paper compares the performance characteristics of the Ca-CaCrO₄ and the Li-Al-FeS₂ systems. Studies were conducted on single cells and batteries in order to evaluate various parameters including operating temperature, pressure, cell composition, thickness, and density. These studies indicate that although the Ca-CaCrO₄ system is competitive at low current densities, the Li-Al-FeS₂ system promises to substantially extend the present domain of high current density thermal batteries. (Author)

A80-11855 Heat generation in Li/SOCl₂ cells. P. Bro (P. R. Mallory Laboratory for Physical Science, Burlington, Mass.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 571-579; Discussion, p. 579-582. 10 refs.

Short duration, constant current discharges of fresh Li/SOCl₂ cells were carried out at 25 and 45 C in a calorimeter with the concurrent monitoring of the cell overvoltage and the heat evolution from the cells. At discharge currents between 20 and 200 mA the cells generated about three times as much heat at 25 C and twice as much heat at 45 C as could be calculated from the cell current and the cell overvoltage at the two temperatures. The heat evolution persisted for a considerable length of time beyond the cessation of the discharge. The results provide evidence for the occurrence of significant chemical reactions in Li/SOCl₂ cells. (Author)

A80-11856 Projected mechanism for thionyl chloride and sulphuryl chloride cathode reactions. G. E. Blomgren, V. Z. Leger, T. Kalnoki-Kis (Union Carbide Corp., Battery Products Div., Parma, Ohio), M. L. Kronenberg (General Electric Co., Gainesville, Fla.), and R. J. Brodd (ESB Technology Co., Yardley, Pa.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 583-592; Discussion, p. 592, 593. 7 refs.

A80-11857 Behaviour of the secondary lithium electrode on alloying substrates in propylene carbonate based electrolytes. J. R. van Beek and P. J. Rommers (Philips' Gloeilampenfabrieken, Philips Research Laboratories, Eindhoven, Netherlands). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 595-621; Discussion, p. 621, 622. 19 refs.

Electrodeposition and dissolution of lithium metal in propylene carbonate based electrolytes have been studied with special emphasis on the morphology and passivating behavior. Both are influenced by using substrate electrodes, which can alloy electrochemically with lithium at ambient temperature. This may result in a considerable improvement of cycle-life and charge retention. Complications arise, however, when long waiting times between plating and stripping are introduced. The stripping efficiency decreases due to formation of compounds from which lithium cannot be stripped. Such a decrease was not observed when aluminum was used as substrate. Lithium deposits on aluminum, however, gave rise to a considerable disintegration of the electrode on cycling. (Author)

A80-11858 Utilization of transition metal phosphorus trisulphides as battery cathodes. A. Le Mehaute and P. Perche (Compagnie Générale d'Electricité Marcoussis, Essonne, France). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 623-635; Discussion, p. 635, 636. 16 refs. Research supported by the Délégation Générale à la Recherche Scientifique et Technique and Direction des Recherches et Moyens d'Essais.

A new positive material, NiPS₃ for an electrochemical cell with a lithium negative electrode has been studied. Characterized by a stacking of two-dimensional slabs, an electrochemical improvement results from the solid solution formation (LiNiPS₃). This study shows the advantage in energy and primary power sources for NiPS₃ compared with TiS₂. Electrochemical limitations are analyzed and measurements of diffusion coefficients in the solid phase are given. (Author)

A80-11859 Lead oxides-lithium cells. M. Broussely, Y. Jumel, and J. P. Gabano (Société des Accumulateurs Fixes et de Traction, Département Piles, Poitiers, France). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 637-645; Discussion, p. 645, 646. 8 refs.

The possibility of using lead and lead-bismuth mixed oxides as positive active materials in organic electrolyte lithium cells with a working voltage similar to those of silver zinc cells has been considered. Button cells of SR 44 size have been developed as a test vehicle and studied under various conditions of discharge rate and storage. This paper describes the performance characteristics obtained under these conditions and suggests in conclusion the possible replacement of silver zinc cells by such systems for a large range of low-rate applications on the basis of cost effectiveness. (Author)

A80-11861 Phosphoric acid fuel-cell electrocatalysts from pyropolymer ceramic composites. L. B. Welsh, R. W. Leyerle (UOP Corporate Research Center, Des Plaines, Ill.), B. S. Baker, and M. A. George (Energy Research Corp., Danbury, Conn.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978.

London, Academic Press, Inc. (London), Ltd., 1979, p. 659-674; Discussion, p. 675, 676. ERDA-supported research; Grant No. DAAG53-76-C-0014.

The properties and performance of a new class of electrocatalysts being developed for phosphoric acid electrolyte fuel cell applications are reported. These electrocatalysts are produced by platinum impregnation of high surface area pyropolymer structures which are prepared by leaching the alumina from small-particle pyropolymer-alumina composites acid. When tested as 0.4-0.6 mg/sq cm Pt-loaded cathodes in model phosphoric acid fuel cells at 180 C, full cell performance levels above 0.60 V at 200 mA/sq cm have been obtained using Pt-black counter electrodes. Both the particle size and pore volume distribution of the electrocatalysts may be controlled by the appropriate choice of starting materials and process condi-

tions. Such control constitutes a substantial improvement in the ability to optimize electrocatalyst structures. (Author)

A80-11862 The electrochemical characteristics of iron sulphide in immobilized salt electrolytes. D. Birt, C. Feltham, G. Hazzard, and L. Pearce (Admiralty Marine Technology Establishment, Poole, Dorset, England). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 691-699; Discussion, p. 699, 700.

While the lithium alloy-iron sulfide couple has attracted considerable attention in recent years for high-temperature secondary battery applications, the high efficiency and good thermal stability of iron sulphide makes it an attractive candidate for high rate, extended duration, primary thermal batteries. The feasibility of using a pile design of battery for iron sulphide coupled with immobilized lithium has been studied with test cells of 8.3 sq cm plate area. Using 10 A min/sq cm cathodes, high rates (up to 1 A/sq cm) and utilization of up to 80% have been achieved over the temperature range 400-700 C. Similar experiments with secondary cells have produced over 100 cycles at the 10 h (25 mA/sq cm) rate, with utilization between 80 and 90%. Cells are capable of sustained discharge at 100 mA/sq cm. (Author)

A80-11863 Recent advances in high temperature primary lithium batteries. M. D. Baird, A. J. Clark (Mine Safety Appliances Co., Ltd., Glasgow, Scotland), C. R. Feltham, and L. J. Pearce (Admiralty Marine Technology Establishment, Poole, Dorset, England). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 701-711; Discussion, p. 712. 8 refs.

The poor efficiency of calcium anodes in existing molten salt primary batteries has been a major constraint in extending their duration beyond a few minutes at high electrode current densities. The development of satisfactory techniques for immobilizing lithium coupled with suitable cathodes, has to a great extent overcome this problem. Studies on a lithium anode system using immobilized salt electrolytes have shown that it is capable of working over a wide range of power densities at high electrode efficiencies. Resulting from this, a new range of pyrotechnically activated batteries has been developed. The basic chemical characteristics of the cell system are discussed and battery data for a number of cell sizes on power and energy are presented, demonstrating the potential of the system with respect to a range of applications. (Author)

A80-11865 Computer modelling of electrically parallel arrays of sodium-sulphur cells. S. P. Mitoff (General Electric Co., Schenectady, N.Y.). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 733-741; Discussion, p. 741, 742. Research supported by the Electric Power Research Institute.

The individual charge and discharge curves of 20 experimental 16 A h sodium-sulphur cells were used as input data for a computer programme. The programme was used to synthesize the behavior of a parallel array of cells with their charge and discharge characteristics. The results predicted that they would deliver about the same power and capacity in the parallel connection as they do when tested individually at constant current. Although the cells get out of phase in ampere hours at the earlier stages of a cycle, they tend to equalize near the end of the cycle. (Author)

A80-11866 Some aspects of sodium-sulphur batteries. M. D. Hames, D. G. Hartley, and N. M. Hudson (British Railways Board, Railway Technical Centre, Derby, England). In: Power sources 7: Research and development in non-mechanical electrical power

sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. (A80-11837 02-44) London, Academic Press, Inc. (London), Ltd., 1979, p. 743-755; Discussion, p. 755, 756. Research supported by the Department of Transport.

Several 3 kW h, 50 V sodium-sulphur batteries have been constructed and tested under constant current and simulated duty cycle rates. These batteries contain 48 central sulphur cells (37 A h) connected as two parallel chains of 24 series cells. Experimental data are presented which illustrates the charge-discharge characteristics, thermal properties and safety aspects of these batteries. (Author)

A80-11867 Current collectors for sodium-sulphur batteries. T. L. Markin, A. R. Junkison, R. J. Bones, and D. A. Teagle (Atomic Energy Research Establishment, Harwell, Oxon, England). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 757-767.

In a previous paper (Bones, Brook and Markin, 1975), it was shown that stainless steel corroded at an unacceptable rate when used as a current collector in the sulphur/polysulphide melt in Na-S cells. A search has since been made for alternative current collectors that will allow Na-S cells to achieve at least 1000 cycles without a significant loss in capacity and have an initial resistance less than 2 ohm sq cm. Moreover, any resistance increase should be small. Fully engineered cells with capacities of 20 A h have been constructed, with the sulphur contained in the beta-alumina electrolyte tube and the sodium in an outer annulus. These were used to evaluate carbon and molybdenum current collectors. Variable results were obtained with molybdenum rod current collectors for reasons associated with the surface chemistry of this metal in polysulphide melts. Anodized molybdenum current collectors were an improvement. Capacities of 72% (based on the weight of S) were maintained after 300 cycles, accompanied by a small increase in resistance. (Author)

A80-11868 An indirect ammonia-air fuel system. C.-S. Cha, Z.-D. Wang, Y.-C. Chu, and C.-T. Lo (Wuhan University, Wuchang, Communist China). In: Power sources 7: Research and development in non-mechanical electrical power sources; Proceedings of the Eleventh International Symposium, Brighton, Sussex, England, September 25-28, 1978. London, Academic Press, Inc. (London), Ltd., 1979, p. 769-773; Discussion, p. 773, 774.

A rather simple ammonia-air fuel cell system has been developed in Wuhan University. Ammonia is cracked to give a 25% N₂, 75% H₂ gas mixture, which is consumed directly in the fuel cell stack. Scrubbed air is supplied to the air electrodes by the 'chimney effect'. No platinum-group metal catalysts are used to fabricate the electrodes and the system contains neither pump nor fan. The system is therefore not expensive and appears to be quite reliable during prolonged unattended operation. The average service life of a fuel cell module is about three months of continuous operation at 50 mA/sq cm. (Author)

A80-11953 Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Edited by R. F. Hill. Washington, D.C., Government Institutes, Inc., 1979. 1167 p. \$38.

Papers presented examine both the technical and institutional aspects of energy technology for an improved energy system in the United States. The proceedings include discussions of: energy policy; institutional opportunities and constraints; the efficient use of energy; technology for fossil, nuclear, and geothermal resources; and technology for renewable energy resources. B.J.

A80-11954 Kentucky's coal-based chemical/energy park. D. D. Drake (Kentucky, Dept. of Energy, Ky.) and H. L. Falkenberry (Tennessee Valley Authority, Knoxville, Tenn.). In: Energy tech-

nology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 56-69.

The Kentucky Department of Energy, assisted by the TVA, is proceeding with plans to develop a coal-based chemical/energy park in western Kentucky. This park will be designed to take high-sulfur coal from western Kentucky and convert it to clear synthetic fuels and feedstocks, which will in turn be used for power generation and as raw materials for a slate of chemical products. The entire operation will be economically viable and environmentally sound. It is concluded that this commercialization effort represents an outstanding opportunity to demonstrate a reproducible, innovative way to meet national energy supply needs with a minimum requirement of federal funding. B.J.

A80-11955 Hydrogen - A means of integrating competing technology into a unified energy system. R. T. Jaske. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 207-214. 12 refs.

The 1975 state of hydrogen energy technology is reviewed, and some criteria for a long range national energy delivery system are outlined. It is found that only a limited number of systems can meet all of the key properties of a nationally optimized, highly independent energy system. The most promising combination appears to be the utilization of breeder reactors or fusion machines to supply thermal energy for generation of electricity and for production of hydrogenous fuel (methane-methanol-hydrogen) for a common pool delivery system. Competitive forces would allocate the shares of electricity and stored fuel on the basis of efficiency and market conditions, guided by national objectives. B.J.

A80-11956 Economic performance - Evaluations for solar energy. F. Roach and S. Noll (California, University, Los Alamos, N. Mex.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 273-284. 16 refs. Research supported by the U.S. Department of Energy.

The LASL/UNM computer code for the economic evaluation of the feasibility of residential solar space and water heating systems is described. The inputs, sets of evaluative procedures, and outputs associated with the code are discussed in detail. Present status and on-going modifications to the various components are highlighted, and the utility of the LASL/UNM code is demonstrated through illustrative examples of recently completed studies. B.J.

A80-11957 Techniques for evaluation of advanced cogeneration technologies. D. H. Brown (General Electric Co., Schenectady, N.Y.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 354-360.

A methodology is presented that characterizes the performance parameters of advanced energy conversion systems for cogeneration. Process temperature is directly coupled to the characteristic of the energy conversion system in a manner that is straightforward, simple, easy-to-check, and requires a minimum of computation. Parameters are expressed as ratios to the cogeneration fuel energy; the more familiar expression of fuel charged to power is shown to be a derivative of these expressions. B.J.

A80-11958 Gas recovery from unconventional sources. A. A. Pitrolo, L. A. Schrider, W. K. Overbey, and R. L. Wise (U.S. Department of Energy, Morgantown Energy Technology Center, Morgantown, W. Va.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 483-494. 11 refs.

Department of Energy R&D activities in the field of unconventional sources of natural gas are reviewed. Emphasis is on four such sources: tight sandstones, Devonian shales, coalbed methane, and geopressed aquifers. B.J.

A80-11959 Combustion of anthracite culm in a fluidized bed boiler. S. Moskowitz (Curtiss-Wright Corp., Wood-Ridge, N.J.), A. M. Leon (Dorr-Oliver, Inc., Stamford, Conn.), and D. A. Rosini (Shamokin Filler Co., Inc., Shamokin, Pa.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 530-538.

The Department of Energy is sponsoring several projects to use anthracite culm, a coal waste material, as a low cost fuel to generate steam in a fluidized bed combustion (FBC) boiler system. These projects involve steam generation units ranging from 20,000 pph for manufacturing processes to 100,000 pph for district heating. One of the projects which is discussed in this paper is directed at design, construction, operation and evaluation of a prototype atmospheric FBC boiler unit, on culm with a heating value as low as 3000 Btu/lb and with an ash content of over 70%. The culm is to be burned in an environmentally acceptable manner to produce 20,000 pph steam for industrial use, although the design is representative of steam generating capacity of 100,000 pph or greater. Details of this program including plant arrangement, FBC design considerations and preliminary combustion data obtained in an FBC technology rig are presented. (Author)

A80-11960 The prospect for anthracite as a national energy resource. J. Pell (U.S. Department of Energy, Div. of Anthracite, Washington, D.C.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 539-552. 22 refs.

The paper presents some basic facts on the utilization of anthracite and describes the development of the DOE Division of Anthracite (DA). The primary objective of the DA is to seek ways to restore anthracite as a viable economic alternative to soft coals and to imported oil and gas now supplying the Northeast. Consideration is given to environmental requirements for new anthracite-fired facilities. B.J.

A80-11961 Economics of Pullman Kellogg's magnesium promoted FGD system. L. Granger, L. J. Scotti, and J. C. Yarze (Pullman Kellogg, Co., Houston, Tex.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 602-616. 6 refs.

A magnesium sulfate-promoted limestone flue gas desulfurization system has been designed for treating flue gas resulting from the combustion of a coal containing 5.75% sulfur. This paper reviews the chemistry of magnesium sulfate-promoted calcium-based and nonpromoted calcium-based flue gas scrubbing, and discusses the advantages of the promoted system for high sulfur content coals. Economic evaluations are presented which include comparisons of reagent and power costs for promoted and nonpromoted limestone systems. Process design and economic analyses of forced oxidation as means of reducing waste slurry disposal costs are discussed. In addition, different slurry dewatering options are reviewed. B.J.

A80-11962 170 MW pressurized fluidized bed combustion electric plant. J. J. Markowsky (American Electric Power Service Corp., New York, N.Y.) and B. Wickstrom (STAL-Laval Turbin AB, Sweden). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 617-629.

A pressurized fluidized bed combustion (PFBC) combustor, when operated in conjunction with a combined-cycle electric power generation, offers the potential for direct combustion of high-sulfur coal without stack gas clean-up, as well as increasing power plant

efficiency and significantly reducing nitrogen oxide emissions. This paper presents the status of a privately funded development program initiated in December of 1976 to determine the technical and economic feasibility of utilizing PFBC for electric power generation. It is concluded that in order to develop PFBC to the point of commercialization, a large-scale Engineering Development System Plant will have to be built and operated. Toward this end, it is proposed to design and build a 170-MW PFBC combined cycle plant which would incorporate the same gas turbine and PFBC combustor that would be used in a commercial size plant. (Author)

A80-11963 Development of fluidised bed combustion in the United Kingdom. W. G. Kaye (National Coal Board, London, England). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 630-638.

The early development of fluidized bed combustion in the United Kingdom is reviewed with reference to: (1) deep-bed technology burning crushed coal with sulfur retention for power generation, and (2) the combustion of larger sizes of coal in shallower beds to satisfy the needs of the industrial market. The current status of these processes is examined, with attention given to pressurized fluidized combustion, atmospheric fluidized combustion, and smaller industrial boilers and furnaces. B.J.

A80-11964 Coal liquefaction - An international perspective. A. Baker and M. D. Teper (International Energy Agency, London, England). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 639-656. 18 refs.

The Coal Research Program of the International Energy Agency is briefly described. This is followed by a discussion of liquefaction processes and their development, some preliminary considerations on liquefaction economics, and some considerations on the future of coal liquefaction. B.J.

A80-11965 Current German developments in coal liquefaction technology. G. Kölling, I. Romey, and E. Wolowski. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 657-663. 6 refs.

The paper examines the IG (or Bergius-Pier) coal liquefaction process, based on slurry phase hydrogenation. Emphasis is placed on current German pilot plants for coal liquefaction, including the Bergbau-Forschung plant, the 200 t/d demonstration plant of Ruhrkohle AG/Veba Oel AG, and the 6 t/d pilot plant of Saarbergwerke AG. Sizes of these plants were chosen so as to enable scaling up to a commercial prototype plant. The possibility of using hydrogenation products as feedstock for the chemical industry is also being investigated. B.J.

A80-11966 Recent developments in coal liquefaction in the United States. L. E. McNeese, R. Salmon, and H. D. Cochran, Jr. (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979.

Washington, D.C., Government Institutes, Inc., 1979, p. 664-686. 28 refs. Contract No. W-7405-eng-26.

The current status of coal liquefaction in the United States is reviewed, with reference to basic chemistry, process research and development, and economics and commercialization. The following processes are described: direct liquefaction, two-stage liquefaction, pyrolysis processes, and indirect liquefaction. Process problems in coal liquefaction are briefly discussed, and some recent economic studies are reviewed. B.J.

A80-11967 SRC solids - Boiler fuel and building block. A. P. Flask (Wheelabrator-Frye, Inc., Keene, N.H.) and J. A. Pryor. In: Energy technology VI: Achievements in perspective; Proceedings of

the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 687-706. 5 refs.

The current status of the solvent refined coal (SRC) process is reviewed. Pilot projects are assessed and the status of SRC technology is surveyed, with reference to: (1) solids separation, (2) hydrogen generation, (3) primary reactor scale-up, and (4) equipment life, maintenance, and operating difficulties. Both the solids and liquids SRC processes are described, and it is noted that market studies indicate that SRC solids have a unique potential for further processing to produce products for basic industries (liquid fuels, anode coke, and metallurgical coke are examples). B.J.

A80-11968 SRC solids - A preferred compliance boiler fuel. S. R. Hart, Jr. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 707-717. 7 refs.

Solid solvent refined coal (SRC-I) is a coal-derived fuel with a high heat content and a low ash and sulfur content. The SRC-I technology has been advanced in pilot plant operations over the past five years to the point where it is now considered to be the best candidate for early commercialization of a coal-derived clean fuel. This paper presents a preliminary outlook on the market potential of solid SRC and gives power plant cost data and information on other key factors which must be evaluated by electric utilities in decisions relating to the future use of solid SRC. B.J.

A80-11969 Low/medium BTU coal gasification - Perspective of the gas industry. R. H. McClelland. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 728-758.

A80-11970 The near term potential for gasification-combined cycle electric power generation. M. J. Gluckman, N. A. Holt, S. B. Alpert, and D. F. Spencer (Electric Power Research Institute, Palo Alto, Calif.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 771-777.

A80-11971 Coal to electricity - Integrated gasification combined cycle. J. C. Corman (GE Research and Development Center, Schenectady, N.Y.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 778-792. 11 refs.

An advanced energy conversion system, Integrated Gasification Combined Cycle (IGCC), has been identified as a viable approach for converting coal to electricity in an environmentally acceptable manner. This concept comprises three subsystems: a gasifier, a gas cleanup system, and a combustion gas turbine combined cycle. A research and development program is in progress to address the major technical requirements in each area. Experimental components have been constructed for each of the three subsystems. These components are also integrated and operated as a process development unit (PDU) simulation of the proposed commercial IGCC system. The results to date verify the performance characteristics of this conversion concept. The low-Btu coal gasification fuel supply system meets the stringent fuel requirements of utility gas turbines and offers the flexibility to meet tightening environmental constraints. (Author)

A80-11972 * Survey of MHD plant applications. J. J. Lynch (U.S. Department of Energy, Washington, D.C.), G. R. Seikel (NASA, Lewis Research Center, Cleveland, Ohio), and J. C. Cutting (Gilbert/Commonwealth, Inc., Reading, Pa.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 793-807. 24 refs.

Open-cycle MHD is one of the major R&D efforts in the Department of Energy's program to meet the national goal of reducing U.S. dependence on oil through increased utilization of coal. MHD offers an effective way to use coal to produce electric power at low cost in a highly efficient and environmentally acceptable manner. Open-cycle MHD plants are categorized by the MHD combustor oxidizer, its temperature and the method of preheat. The paper discusses MHD baseline plant design, open-cycle MHD plant in the Energy Conversion Alternatives Study (ECAS), early commercial MHD plants, conceptual studies of the engineering test facility, retrofit (addition of an MHD topping cycle to an existing steam plant), and other potential applications and concepts. Emphasis is placed on a survey of both completed and ongoing studies to define both commercial and pilot plant design, cost, and performance. S.D.

A80-11973 The reality of on-site fuel cells. R. T. Sperberg and V. B. Fiore. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 808-810.

On-site phosphoric acid fuel-cell systems are considered. The electrical efficiency of such a cell is shown to be 40% and to be increased to about 80% with waste-heat recovery. Applications of on-site fuel cells with heat recovery coupled with heat pumps are discussed, along with the current objectives of research on phosphoric acid fuel cells. F.G.M.

A80-11974 Commercial applications of molten carbonate fuel cell systems. K. F. Blurton (Institute of Gas Technology, Chicago, Ill.) and J. R. Peterson (General Electric Co., Fairfield, Conn.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 811-825.

The paper examines the potential applications of molten carbonate fuel cells. Attention is given to two configurations, a dispersed, oil fueled power plant, and a coal fueled base load power plant. The penetration of these power plants into the utility generation system is described. The status of this technology is reviewed, and the major technology areas currently under investigation are discussed. These include: electrolyte tile, contaminant tolerance, fuel cell endurance, and stack design. Finally, attention is given to gas composition and component production. M.E.P.

A80-11975 Economics/reliability trade-offs in materials for various coal conversion and utilization processes. M. K. Guha (American Electric Power Service Corp., New York, N.Y.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 826-835.

The economics and reliability in materials for coal conversion and utilization processes with emphasis on the conventional coal-burning system, pressurized fluidized bed combustion, and open cycle coal-fired magnetohydrodynamics power generation are examined. Corrosion and stress corrosion cracking are the most important problems in conventional systems, which are discussed relative to steam turbines, high pressure feed water heaters, and scrubbers. In direct and indirect coal conversion processes, combined effects of erosion and corrosion by sulfides and chlorides are considered, which affect heat transfer surfaces and in-bed tubes in the fluidized bed equipment. In magnetohydrodynamic (MHD) power generation, the high-temperature air heater, combustor and nozzle, and MHD generator are considered, noting that the combustor must be ceramic-lined to withstand temperatures up to 3200 F for which alumina-chrome materials may be suitable, but the materials selection for the MHD generator requires further investigation. A.T.

A80-11976 Status of inertial confinement fusion. C. M. Stickley (U.S. Department of Energy, Washington, D.C.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 871-877.

Progress in the U.S. Department of Energy's Inertial Confinement Fusion program is reviewed. Program objectives for the scientific feasibility phase, which extends through the mid-1980's, are presented and the capabilities of the major program participants are summarized. Drivers for inertial confinement fusion reactors currently occupying project status include glass lasers, CO₂ lasers and electron and light-ion beams, while short-wavelength lasers and heavy-ion beams are undergoing technology development. Target interaction experiments have involved the interaction of lasers with glass microballoon targets or exploding pusher targets, and isentropic compression or ablative compression targets have recently come under investigation. In addition, the transport of focused laser and light-ion beams has been demonstrated and advanced reactor technology for energy applications is being developed. Advantages to the inertial confinement scheme include the limitation of physics questions to the pellet burning phase and the modularity of inertial confinement technology, and it is expected that the scientific feasibility of inertial confinement fusion will be demonstrated in the mid-1980's. A.L.W.

A80-11977 Geothermal resources of the Atlantic Coastal Plain. J. K. Costain (Virginia Polytechnic Institute and State University, Blacksburg, Va.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 878-880.

Optimum sites for the development of geothermal energy in the eastern United States will probably be associated with the flat-lying sediments beneath the Atlantic Coastal Plain. Basement granitic rocks relatively enriched in uranium and thorium and thus sources of geothermal energy are currently being sought beneath thick, porous, thermally insulating coastal sediments by a combination of gravimetric and geological methods. Measurements of a series of 1000-foot holes drilled into the sediments of the Atlantic Coastal Plain between New Jersey and Georgia indicate that the highest thermal gradients (45 C/km) occur in the Delmarva Peninsula, with maximum temperatures of 85 C. A geothermal test well is planned near Crisfield, Maryland to evaluate the productivity of deep aquifers in sediments of the Atlantic Coastal Plain. A.L.W.

A80-11978 Geothermal energy markets on the Atlantic coastal plain. W. J. Toth and F. C. Paddison (Johns Hopkins University, Laurel, Md.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 881-895. 10 refs.

A survey of potential energy markets for geothermal resources up to 250 F made for the Atlantic coastal plain in New Jersey, the Delmarva Peninsula, Virginia, and North Carolina is presented. 175 companies have process heat requirements that could be satisfied by potential geothermal resources, and data were also analyzed for space and water heating requirements in the residential, commercial, and military, and agricultural sectors. The geothermal energy system components, such as the production well, the wellhead heat exchanger, and peaking plants, were approximately sized, and wellhead and delivery costs to various types and densities of users were considered. Wellhead costs to large industrial users can be competitive with conventional energy sources, and delivered costs to residential users can be competitive with current fuel oil and natural gas prices, and well below costs of electrical resistance heating. A.T.

A80-11979 Overview of division of energy storage program - Department of energy. G. F. Pezdirtz (U.S. Department of Energy, Div. of Energy Storage Systems, Washington, D.C.). In: Energy technology VI: Achievements in perspective; Proceedings of

the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 896-903.

The division of Energy Storage Systems of the U.S. Department of Energy was created in order to develop and seek out applications for new and more efficient energy storage techniques. The paper reviews the activities of the division from the point of view of the diversity of central and dispersed energy storage applications. The potential energy savings of the various forms of energy storage under consideration are outlined, and a timetable for the commercialization of energy storage batteries, chemical and thermal systems and physical methods is presented. Particular attention is given to programs investigating compressed air and battery storage for utility load leveling, thermal energy storage for industrial waste heat, aquifer storage of cooled water, the electrolytic production of hydrogen using low-head hydroelectric power, customer-owned thermal energy storage, lead-acid, nickel zinc, nickel iron, sodium sulfur, lithium/metal sulfide and aluminum air batteries and flywheel energy storage for electric vehicles and gasoline/electric hybrid vehicles. A.L.W.

A80-11980 Development of renewable energy sources in the United Kingdom. G. Long (Department of Energy, Energy Technology Support Unit, Harwell, Oxon, England). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979.

Washington, D.C., Government Institutes, Inc., 1979, p. 905-925. 9 refs.

In presenting a survey of UK energy research and development to the Second Energy Technology Conference in 1975, Leighton described the steps then being taken to further the development of renewable energy sources. In the present paper, the research programs which have stemmed from the assessments are reviewed. The approaches to two technologies - solar energy and wave power - with very different R&D requirements, are outlined. V.P.

A80-11981 Pelletized wood /Woodex/ - Applications and potential. D. C. Walker and W. F. Brimer. In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 992-997.

The paper surveys Woodex, a pelletized fuel, produced from biomass waste products and materials, and which is claimed to be a clean burning renewable energy source from domestic supply. The pellets are reported to generate a maximum 3% ash, contain no sulfur, and in most areas cost less per therm than traditional fuels. In addition, Woodex contains some 8,500 BTUs per pound at about 35 pounds per cubic foot bulk density, and can be burned in its pelletized form, reduced in size for direct combustion, or processed into a fuel gas. Further, it is claimed that in almost all cases Woodex burns with emissions below those required by the EPA under the clean air act. Finally, it is noted that the fuel can be burned in most systems using coal with little or no modifications required. M.E.P.

A80-11982 Supply, harvesting and nature of forest biomass as a fuel. J. P. Elwood (International Paper Co., Bellusco, Italy). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1004-1014. 8 refs.

A review of the critical technical and economic barriers to increased use of forest biomass fuel is presented. Three scenarios for forest biomass fuel production and use are outlined: an integrated pulp and paper mill, a regional electric power generating plant and a fuel plantation. These types of operations are compared to each other and to a forest products plantation to illustrate strategic, technical and economic differences and similarities. Finally, several recent or current developments in harvesting equipment are described. (Author)

A80-11983 Source, supply and nature of municipal and industrial waste as a fuel. W. R. Niessen (Camp, Dresser and McKee,

Inc., Boston, Mass.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1015-1025. 10 refs.

A80-11984 Economy of a retrofit solar system. J. M. Schreyer (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1029-1041. Contract No. W-7405-eng-26.

A privately financed, double-glazed, flat-plate-collector-driven, solar-augmented hot water system was installed on an existing dwelling in which the hot water consumption averaged about 30 gallons per day. Data were obtained on the collector water temperature, storage tank temperature, amount of hot water used, and amount of supplemental electricity required. Using the data obtained from this \$1500 installation, it is shown that the payback period would be about 10 years. This assumes the replacement of electrical energy costing 5 cents per kWh, hot water usage rate of 30 gal/day and money borrowed at 10.5% interest. If the usage rate were 55 gal/day, the payback period would be about 5 years.

(Author)

A80-11985 Commercial building and industrial applications for solar energy. V. R. Daiga (Owens-Illinois, Inc., Pittsburgh, Pa.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1046-1055.

The application of solar thermal energy collected by an evacuated tube collector to the supply of heat to commercial buildings and industrial processes is discussed. Evacuated tube solar collectors are described and the Sunpak solar collector, which consists of a manifold of 24 evacuated tubes, is presented. It is shown that the energy output characteristics of the Sunpak system exhibit a higher operating efficiency and lower thermal losses and ambient temperature sensitivity compared to a flat plate solar collector with double glazing and a selective coating. The Sunpak collector has been applied to the heating and cooling of new and retrofitted commercial buildings, schools and industrial buildings, and in the supply of heat for a beer pasteurization process, utilizing various Sunpak-building interfaces in different climates. Experience has shown the collector system designs to be suitable to commercial and industrial process applications requiring heat up to 240 F, with favorable user reaction and maintenance requirements. A.L.W.

A80-11986 Low-cost central receiver solar power plant using molten salt as a heat transfer and storage medium. T. R. Tracey (Martin Marietta Aerospace, Bethesda, Md.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1059-1065.

The paper proposes an alternative approach to solar thermal power plants to reduce the electricity cost relative to the first generation water/steam systems. The cost reduction is achieved by generating a 950 F 2400 psig steam by pumping an eutectic salt mixture of sodium nitrate and potassium nitrate as the heat transfer and storage medium to the steam generator and/or storage tank. The salt is inexpensive, has a very low vapor pressure at the use temperatures, does not react with air or water, and is not toxic. Studies of plant size, storage, collector field configuration, and receiver type indicate that the thermal storage cost below \$5.00/KWh and electricity cost below 40 mills/KWh are a reasonable goal. A.T.

A80-11987 Industrial solar total energy systems. J. E. Rogan (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1066-1076. Contract No. EY-C-76-03-1132.

A program to define feasible solar energy systems which satisfy selected industry demands, and to determine the market potential of such systems is presented. The application of total energy systems where the industrial process heat, electrical demands, and space heating and cooling are satisfied at maximum efficiency was emphasized. Industrial energy usage was surveyed to produce first-level designs, and subsystem methodologies were established in collector performance and sizing, thermal storage, energy conversion, and heat transport. More than 40 first-level designs were generated in meat-packing, fluid milk, sugar beets, asphalt, and concrete block industries. Conceptual designs were then generated to determine system economics and market penetration showing positive returns on investment in the small central receiver configuration, and indicating that high performance distributed collectors, high-temperature low-vapor-pressure fluids, and small turbines need to be developed. A.T.

A80-11988 Near-term prospects for solar industrial process heat. K. C. Brown (Solar Energy Research Institute, Golden, Colo.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1077-1085. 10 refs.

The paper reviews the state of solar technology and evaluates the prospects for early application and impact of solar industrial process heat. The distribution of the industrial process heat (IPH) demand by market required temperatures, and operating temperature ranges of solar collectors, including heliostat-power tower, point focus, and flat plate, are discussed. The twenty pilot projects which demonstrate the feasibility of solar energy to supply hot water, hot air, and steam to industrial process needs are described, noting that cost reductions will be achieved through experience, but the deleterious effects of air pollutants in the plant environment on solar system performance must be considered. It is concluded that the near-term impact of solar process heat will be affected by the resolution of key problems, which include the removal of economic uncertainties and unequitable subsidies, market identification, cost reduction, performance improvement, and accumulation of operating experience. A.T.

A80-11989 Improvements in the performance of a low cost thin film solar cell. J. D. Meakin (Delaware, University, Newark, Del.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1088-1096. 11 refs. Contract No. EG-77-C-03-1576.

Improvements in the energy conversion efficiency of the low-cost CdS/Cu₂S solar cell are reviewed. The development of the thin-film CdS solar cell up to 1975 is shown to have led to an average CdS cell efficiency of 6.1%. A formalized procedure for cell development based on a complete analysis of efficiency-limiting mechanisms, termed loss minimization, was then developed, resulting in a hybrid grid structure with a conversion efficiency of 8.55%. Subsequent modifications to the gridding have resulted in the demonstration of a 9.15% efficiency solar cell, which is close to its design limit, and technology improvements necessary to reach an efficiency of up to 11% have been defined. The substitution of zinc for 15% to 25% of the cadmium has been predicted to lead to efficiencies greater than 14%. A continuous-process pilot plant presently under construction is expected to demonstrate the feasibility of constructing and operating a full-scale manufacturing plant for CdS/Cu₂S solar cells capable of selling for as little as \$250/kW as early as 1986. A.L.W.

A80-11990 Materials resource requirements and potential limitations in solar energy products. R. L. Watts (Battelle Pacific Northwest Laboratories, Richland, Wash.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1097-1113.

A systematic methodology for identifying material constraints to the future expansion of advanced energy supply technologies is presented and applied to various solar energy applications. The identification process involves tracking the sources of technology components by means of an interactive computer system and evaluating their supply according to defined thresholds at various supply levels. Nine solar heating and cooling of buildings designs and three agricultural and industrial process heat designs, assuming scales of 500,000,000 sq m of collector area by the year 2000, are shown to be free of serious future material limitations; however, certain market and production variables indicated that it would be necessary to require monitoring of the supplies of iron and steel, soda lime glass and polyvinyl fluoride. For 13 photovoltaic cell designs in 15 configurations with total powers of 50 GWe by the year 2000, the analysis indicates definite availability constraints for indium, gallium and germanium in certain photovoltaic systems. A.L.W.

A80-11991 Materials research - Probable impacts on solar energy. D. K. Benson (Solar Energy Research Institute, Golden, Colo.). In: Energy technology VI: Achievements in perspective; Proceedings of the Sixth Conference, Washington, D.C., February 26-28, 1979. Washington, D.C., Government Institutes, Inc., 1979, p. 1114-1126. 6 refs. Contract No. EG-77-C-01-4042.

Consideration is given to the development of a materials science research program in order to accelerate the commercialization of solar energy conversion technologies by improving materials quality and decreasing life cycle costs. The methodology of research plan development includes the identification of materials problems and opportunities, the design of research paths for materials innovation or improvement, cost, benefit and success probability predictions, and synthesis into a program designed to maximize the probable benefit/cost ratio. Preliminary results of the solar materials research design methodology in use at the Solar Energy Research Institute are indicated, and it is shown that even a small improvement in the performance of certain solar technologies, especially utility-based OTEC, wind and solar thermal, can lead to large increases in market penetration and large displacements of fossil fuels. It is noted that materials studies can lead to fuel savings many times greater than the cost of initial research. A.L.W.

A80-11992 Ambient air measurements of petroleum refinery emissions. K. Sexton and H. Westberg (Washington State University, Pullman, Wash.). *Air Pollution Control Association, Journal*, vol. 29, Nov. 1979, p. 1149-1152. 12 refs. Research supported by the U.S. Environmental Protection Agency.

An ambient air monitoring program to characterize airborne emissions from the Exxon petroleum refinery at Benicia, California was conducted during September 8-22, 1975. Ground level sampling facilities and an instrumented aircraft provided an integrated, three-dimensional monitoring network. Measurements made during the study included ozone, oxides of nitrogen, methane, carbon monoxide, individual C₂-C₆ hydrocarbons, halocarbons, condensation nuclei, visual distance and various meteorological parameters. The study focused on three major areas: (1) the characterization of gaseous components within the refinery effluent, especially non-methane hydrocarbons and ozone, (2) natural sunlight bag irradiation experiments to determine the ozone forming potential of refinery emissions, and (3) an investigation of changes in plume chemistry as refinery emissions were transported downwind.

(Author)

A80-12027 # Stability of a system of coaxial superconducting shells (Ob ustoiichivosti koaksial'noi sistemy sverkhprovodiaschikh obolochek). R. N. Ovakimian (Akademiia Nauk Armianskoi SSR, Institut Mekhaniki, Yerevan, Armenian SSR). *Akademiia Nauk Armianskoi SSR, Izvestiia, Mekhanika*, vol. 32, no. 3, 1979, p. 42-55. 8 refs. In Russian.

The paper investigates the stability of a system of superconducting coaxial cylindrical shells under the influence of electromagnetic loads. The effect of the cryogenic liquid is neglected. The

Maxwell equations are solved to obtain expressions for the linear current density and the magnetic field intensity. A dispersion equation is derived for the case of loading the system of current-carrying shells with a transverse electromagnetic force. The critical values of the electromagnetic load are determined by computer for different sizes of the inner shell. It is shown that the current-carrying shell is more stable in the coaxial system than when it is in a free state. S.D.

A80-12049 The physics of laser fusion. H. Motz (Oxford University, Oxford, England). London and New York, Academic Press, 1979, 299 p. 207 refs. \$40.50.

The basic physical aspects of laser-driven fusion are considered. Fusion reactions and the generation of power from them are discussed and laser systems are treated. Plasma physics is introduced, with discussions of collective motions, wave propagation and transverse waves, and nonlinear plasma processes, including stimulated and spontaneous transitions, Cerenkov radiation, scattering processes and filamentation, are discussed. Attention is given to the quasi-potential, the ponderomotive force and the emission and absorption of laser light by an inhomogeneous plasma surrounding the target. Shock waves and implosions are treated, with consideration of shock propagation, detonation and the isentropic compression of thin shells, and the Rayleigh-Taylor and Bénard instabilities are considered. The characteristics of plasmas at high density, pressure and temperature are examined, and the Medusa and simulation computer codes are presented. Results from experiments concerning temperature determination, ion spectra, absorption and profile steepening are also reviewed. A.L.W.

A80-12125 Performance of silicon solar cells in front of a water absorber. J. D. Arora and P. C. Mathur (Delhi, University, Delhi, India). *International Journal of Electronics*, vol. 47, Aug. 1979, p. 167-170. 5 refs.

I-V curves as a function of path length in ordinary and distilled water have been measured for two n-on-p diffused junction silicon solar cells. The normalized short circuit current and normalized conversion efficiency for the cells for different path lengths are determined from the I-V curves and comparison of the experimental results has been made with theoretical calculations. It is found that the agreement between the theoretical and experimental results is better for the cell having low substrate acceptor concentration. The agreement is still better with distilled water results. (Author)

A80-12128 # Measurement of gaseous hydrogen chloride emissions from municipal refuse energy recovery systems in the United States. R. Rollins and J. B. Homolya (U.S. Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, N.C.). *Environmental Science and Technology*, vol. 13, Nov. 1979, p. 1380-1383. 14 refs.

Measurements were carried out at two refuse energy recovery systems to assess the atmospheric emissions of HCL. Flue gas measurements data were used to establish both emission factors and mass emission rates. The latter were used as inputs to an elevated point source dispersion model to estimate maximum surface concentrations of HCL under a variety of meteorological conditions. The projected ambient HCL levels associated with refuse energy recovery processes raise a question regarding the potential for significant materials damage resulting from uncontrolled emissions. (Author)

A80-12166 Flywheels for energy storage. A. R. Millner (MIT, Lexington, Mass.). *Technology Review*, vol. 82, Nov. 1979, p. 32-40. 8 refs.

Flywheels are considered as an economical means of storing energy generated by solar and wind power systems and electric utilities when demand is low until the demand is high. The structural failure modes of flywheel materials are examined, noting the favorable characteristics of anisotropic wound fiber or fiber composite construction, and estimates of rotor size on the order of one

ton for domestic applications (40 kWh storage capacity) are presented. Magnetic bearings are proposed as means of eliminating rotor drag in a vacuum environment while drawing only a small current and being capable of operating for at least 20 to 30 years. The design of motor-generators to convert electrical energy to mechanical energy and back again is examined, and brushless magnetic motor-generators are discussed. Cost comparisons show that flywheel storage could be cost-competitive with battery systems over a 20-year lifetime. A.L.W.

A80-12244 Activity tests of various catalysts for hydrocracking of coal by means of high pressure differential thermal analysis. K. Tanabe, H. Sasaki, H. Hattori, K. Ouchi, K. Makino, H. Itoh (Hokkaido University, Sapporo, Japan), and G. Takeya (Hakodate Technical College, Hakodate, Japan). *Fuel Processing Technology*, vol. 2, Oct. 1979, p. 253-259. 12 refs.

The activities of fourteen kinds of catalysts for the hydrocracking of Taiheiyō coal were examined by a high pressure differential thermal analytical method. Exothermic peaks appeared at low temperatures (420-430 C) when MoO₃-TiO₂, Ni-Y zeolite and Co-Y zeolite were used as catalysts, indicating that these catalysts are highly active compared with other catalysts, including MoO₃-CoO-Al₂O₃. The qualitative analysis of gas and liquid products revealed that MoO₃-TiO₂ and Co-Y are good catalysts for the liquefaction reaction. The hydrogenation ability of the catalyst is concluded to be more important than its acidity. (Author)

A80-12245 An update of German non-isothermal coal pyrolysis work. H. Jüntgen and K. H. Van Heek (Bergbau-Forschung GmbH, Essen, West Germany). *Fuel Processing Technology*, vol. 2, Oct. 1979, p. 261-293. 50 refs.

The paper describes the theoretical and experimental approaches used and the results obtained so far from basic studies of coal pyrolysis at Bergbau-Forschung. Attention is given to nonisothermal kinetics of gas formation, interplay of devolatilization with combustion, interaction of pyrolysis and gasification, and pyrolysis under extremely high temperatures. Further work must take pressure into account, as trends in modern coal processing are toward elevated pressures in gasification and even combustion. Pressure could also be an additional factor in controlling the rates and yields of products. S.D.

A80-12246 Catalysis of hydrogen transfer in a tetralin-coal system. M.-C. Tsai and S. W. Weller (New York, State University, Buffalo, N.Y.). *Fuel Processing Technology*, vol. 2, Oct. 1979, p. 313-316. 7 refs. Research supported by the U.S. Department of Energy.

The paper is concerned with hydrogen donation from tetralin to coal in the presence of either 'cobalt-molybdate'-alumina (Co/Mo/Al₂O₃) or stannous chloride (SnCl₂·2H₂O). The former is known to be outstanding for hydrodesulfurization, the latter for hydroliquefaction of coal. Procedures and calculation methods differ in detail from those described by Neavel (1976), but definitions of hydrogen transfer and coal conversion are the same as his. The experiments are conducted in a small turbine reactor. As preliminary 'blank' experiments, two runs at 400 C are made with tetralin in the absence of coal but in the presence of catalyst in order to establish whether the reaction tetralin yielding naphthalene + H₂ proceeds to any appreciable extent. Results in all the tetralin-coal runs are summarized in tabular form. For one coal, at least, the experiments demonstrate that hydrogen transfer at 400 C from tetralin to coal can be catalyzed by either Co/Mo/Al₂O₃ or SnCl₂·2H₂O, the latter being more effective. S.D.

A80-12310 Processing of coal, oil sand and heavy oil in situ by electric and magnetic fields. S. T. Fisher (F. T. Fisher's Sons, Ltd., Montreal, Canada). *Canadian Electrical Engineering Journal*, vol. 14, Oct. 1979, p. 15-18. 6 refs.

The paper presents the results of a study made to determine the feasibility of extracting the energy commodities - electricity, gas, petroleum, coke, and chemical feedstocks - from coal, oil sand, and

heavy oil, heating the deposits by electric and magnetic fields. It is reported that available electrical and chemical data indicate that this process may be technically and economically feasible. It is noted that some basic data are missing making it necessary to indicate possible ranges of values for some parameters. It is tentatively concluded that: (1) all these solid fossil fuels can be successfully processed underground, (2) all five energy commodities can be produced economically in adequate quantities for a period of a century or more, and (3) the development and construction time required is short enough to permit uninterrupted supply of energy commodities as present sources decline. M.E.P.

A80-12311 Physical modelling of the electromagnetic heating of oil sand and other earth-type and biological materials. F. E. Vermeulen, F. S. Chute, and M. R. Cervenak (Alberta, University, Edmonton, Canada). *Canadian Electrical Engineering Journal*, vol. 4, Oct. 1979, p. 19-28. 25 refs. Research supported by the Alberta Oil Sands Technology and Research Authority and Natural Sciences and Engineering Research Council.

Maxwell's equations and the thermal equation for heat flow are considered and scaling criteria are developed which show that it is possible to construct scaled physical models in which the electromagnetic and thermal phenomena of the full scale system can be modeled simultaneously. It is demonstrated that simultaneously modeling is made possible by simulating electromagnetic frequency and thermal events on different time scales. It is also shown that simultaneous modeling of electromagnetic and thermal phenomena can be carried out when the electrical conductivity of the medium of the full scale system is temperature dependent. The electrical and thermal properties of oil sand and the general problem of in-situ recovery of oil therefrom have been used to guide the development of the modeling criteria. It is concluded that the results obtained can be applied to a large class of other problems as well, such as electromagnetic heating of earth-type materials in the mining and construction industry, as well as the electromagnetic heating of food stuffs and biological tissue. M.E.P.

A80-12426 Computers in the design of solar energy systems. S. A. Klein, J. W. Mitchell, J. A. Duffie, and W. A. Beckman (Wisconsin, University, Madison, Wis.). *Energy* (UK), vol. 4, Aug. 1979, p. 483-501. 58 refs. NSF-supported research; Contract No. E(11-1)-2588.

The methodology developed for detailed simulations of solar energy systems is presented. Consideration is given to the development of models for several specific system components from which the simulation model of a system is composed. The models are formulated from basic engineering principles, and a sensitivity analysis is performed to find those simplifications which yield a computational efficient, yet accurate, solution. Three components, a collector, storage tank, and building structure, are used as examples. These components are then combined into a simulation model for the space and hot water heating system of the Solar House. The performance data available from this house is compared with the simulation results. Emphasis is placed on simplified design methods based on the results of detailed computer simulations. V.T.

A80-12427 On the performance of air-based solar heating systems utilizing phase-change energy storage. J. J. Jurinak and S. I. Abdel-Khalik (Wisconsin, University, Madison, Wisc.). *Energy* (UK), vol. 4, Aug. 1979, p. 503-522. 22 refs. Contract No. E(11-1)-2588.

Simulation techniques are used to examine the performance of air-based solar heating systems utilizing phase change energy storage (PCES). The effects of storage size, melting temperature, and latent heat on the thermal performance of the system are quantified for various load characteristics, collector types, and control strategies. The effect of semi-congruent melting of the phase-change material (PCM) on system performance is also examined. Based on these simulations, (1) optimum physical properties of the PCM have been identified, (2) an empirical method for sizing PCES units has been developed, (3) a system-oriented figure of merit for comparing different PCMs has been established, and (4) the economic gains

associated with the storage volume reductions achieved with PCES, vis-à-vis sensible heat storage in rock beds, have been quantified.

(Author)

A80-12428 Insolation modeling overview. E. C. Boes (Sandia Laboratories, Albuquerque, N. Mex.). *Energy* (UK), vol. 4, Aug. 1979, p. 523-529. 9 refs. Contract No. DE-AC04-76DP00789.

This paper gives a summary of some of the major national projects in the area of solar radiation resource assessment. It also discusses the primary solar radiation data sources for the U.S. and the models that were used in developing these sources. Recommendations for appropriate solar radiation resource information for various types of solar system design and analysis needs are given. (Author)

A80-12429 Validation of computer models for predicting radiation levels on tilted surfaces. L. J. Lantz and C. B. Winn (Solar Environmental Engineering Co., Fort Collins, Colo.). *Energy* (UK), vol. 4, Aug. 1979, p. 531-536. 8 refs.

A methodology is developed for the validation of computer models used to predict the instantaneous radiation on a tilted surface, given the similar radiation on the horizontal surface. The resulting methodology is also used to evaluate algorithms used to predict horizontal radiation from surface and cloud cover statistics as well as the radiation model used in program SOLCOST which predicts the expected mean daily total radiation for a specific surface and location using primarily the per cent of possible sunshine value. Attention is given to the three phases of the validation process: (1) collection and evaluation of measured data, (2) discussion of model logic and assumptions, and (3) consideration of the statistics of model calculation versus measured results. Finally, the model validation methodology is presented and illustrated by analysis of four computer models used to predict instantaneous radiation levels on tilted surfaces. M.E.P.

A80-12430 Solar cooling performance predictions via stochastic weather algorithms. D. K. Anand and I. N. Deif (Maryland, University, College Park, Md.). *Energy* (UK), vol. 4, Aug. 1979, p. 537-548. 5 refs. Contract No. EY-76-S-05-4976-A003.

A80-12431 Validation methodology for solar heating and cooling systems. D. K. Anand, W. J. Kennish, A. C. Stolarz (TPI Inc., Energy Systems Analysis, Beltsville, Md.), and T. M. Knasel (Science Applications, Inc., McLean, Va.). *Energy* (UK), vol. 4, Aug. 1979, p. 549-560. 15 refs. Contract No. EM-78-C-04-4261.

The paper presents the validation methodology for solar heating and cooling computer programs to provide levels of confidence associated with detailed and simplified analysis models. A 4 level methodology is proposed, the first dealing with the validation of simulation programs with respect to unmodeled parameters, the second addressing the inaccuracies in simplified analysis procedures due to unmodeled parameter variation, while level three deals with assessment of variation in results due to the field variation of modeled parameters. Level four provides a verification of the results of level three by comparison studies with field performance data, resulting in a quantification of the level of confidence with which the simplified analysis program can be used. A case study was prepared to illustrate the Monte Carlo techniques suggested in levels two and three, concluding that this validation methodology will help establish an efficient solar system testing program. A.T.

A80-12432 Instrumentation principles for performance measurement of solar heating systems. N. Lior (Pennsylvania, University, Philadelphia, Pa.). *Energy* (UK), vol. 4, Aug. 1979, p. 561-573. 49 refs. Research supported by the U.S. Department of Energy.

An instrumentation design and implementation plan for monitoring the performance of solar heating systems and their components is described. Specifically, the selection of the data acquisition system and of the sensors, the procurement process, and installation and calibration principles are discussed in detail. As a practical example, the cost and choice of measurement methods and

instruments used in the University of Pennsylvania SolaRow house are presented. (Author)

A80-12433 A microeconomic approach to passive solar design - Performance, cost, optimal sizing and comfort analysis. S. Noll and W. O. Wray (California, University, Los Alamos, N. Mex.). *Energy* (UK), vol. 4, Aug. 1979, p. 515-591. 13 refs. Research supported by the U.S. Department of Energy.

This paper presents a microeconomic methodology for the analysis and design evaluation of residential passive solar heating applications. Results from PASOLE, an hour-by-hour thermal network simulation program developed at Los Alamos, are used to graphically evaluate design-performance tradeoffs and to estimate quantitative interpolative relationships within the context of economic production function theory. Solar performance isoquants are generated and combined with architectural costs estimates to arrive at least-cost expansion paths along which the optimal life-cycle system can be determined. Comfort considerations, sizing limitations, building code restrictions and other factors introduce constraints in the design process, which can be dealt with qualitatively or quantitatively through a constrained optimization procedure.

(Author)

A80-12434 Optimal insulation of solar heating system pipes and tanks. G. F. Jones and N. Lior (Pennsylvania, University, Philadelphia, Pa.). *Energy* (UK), vol. 4, Aug. 1979, p. 593-621. 10 refs. Research supported by the Pennsylvania Science and Engineering Foundation, U.S. Department of Housing and Urban Development, and U.S. Department of Energy.

A compact and time-effective insulation design procedure for solar heating system piping and water-filled thermal storage tanks is presented. The economics were treated by a present-value life-cycle cost analysis by determining the effects of piping variables and tank heat transfer coefficient values. It was found that only the pipe or tank diameter, the thermal conductivity of insulation, and the insulation thickness affect the overall heat transfer coefficient; the design data based on this result are presented which can be used to determine the optimal insulation thickness and type, annual heat losses, present-value annual insulation costs and lost heat, and overall insulation R-values. A major conclusion is that insulation cost in solar systems is significant, and that heat losses through insulation can amount to an important portion of the useful solar energy collected.

A.T.

A80-12435 Passive and active residential solar heating: A comparative economic analysis of select designs. F. Roach, S. Noll (California, University, Los Alamos, N. Mex.), and S. Ben-David (New Mexico, University, Albuquerque, N. Mex.). *Energy* (UK), vol. 4, Aug. 1979, p. 623-644. 13 refs. Research supported by the U.S. Department of Energy.

A comparison is made between four passive solar heating concepts and a conventional air collector/rock storage system. Masonry (Trombe) and water walls are considered in the presence and absence of night insulation, and the performance of optimally sized systems is evaluated on a state-by-state basis. In addition, the effects of low interest loans and National Energy Act (NEA) income tax credits are examined. It is shown that with natural gas as the alternative fuel, the passive designs evaluated offer more promise than the active system. In addition, it is noted that the passive designs are economically competitive against the electric resistance alternative in all but a few states. Finally, on a life cycle cost basis, these designs are shown to be feasible today.

M.E.P.

A80-12436 The marginal cost of electricity used as backup for solar hot water systems - A case study. R. Bright and H. Davitian (Brookhaven National Laboratory, Upton, N.Y.). *Energy* (UK), vol. 4, Aug. 1979, p. 645-661. 10 refs. Contract No. EY-76-C-02-0016.

A80-12437 Determination of the optimal solar investment decision criterion. M. R. Sedmak (Booz Allen and Hamilton, Inc., Bethesda, Md.) and E. M. Zampelli (PRC Energy Analysis Co., McLean, Va.). *Energy* (UK), Aug. 1979, p. 663-683. 10 refs.

This paper deals with the validity of the solar investment decision criteria employed in various studies. The life-cycle cost criterion (or positive net present value criterion) commonly used by solar analysts is examined, and it is shown that, given the theoretical hypotheses of dynamic investment planning and decision making, this criterion is suboptimal for evaluating the economic viability of fuel-saver solar systems. The optimal 'present cost competitive' criterion is then established and analyzed. The effect of uncertainty is introduced into the analysis by an examination of the payback-period criterion. To highlight the differences between these criteria, a comparison of the timing of and net benefits derived from investments in a residential solar space and water heating system made under each criterion is presented.

(Author)

A80-12438 * A high performance porous flat-plate solar collector. F. L. Lansing, V. Clarke (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and R. Reynolds (Kentrol International, Inc., Pasadena, Calif.). *Energy* (UK), vol. 4, Aug. 1979, p. 685-694. 15 refs. Contract No. NAS7-100.

A solar collector employing a porous matrix as a solar absorber and heat exchanger is presented and its application in solar air heaters is discussed. The collector is composed of a metallic matrix with a porous surface which acts as a large set of cavity radiators; cold air flows through the matrix plate and exchanges heat with the thermally stratified layers of the matrix. A steady-state thermal analysis of the collector is used to determine collector temperature distributions for the cases of an opaque surface matrix with total absorption of solar energy at the surface, and a diathermanous matrix with successive solar energy absorption at each depth. The theoretical performance of the porous flat plate collector is shown to exceed greatly that of a solid flat plate collector using air as the working medium for any given set of operational conditions. An experimental collector constructed using commercially available, low cost steel wool as the matrix has been found to have thermal efficiencies from 73 to 86%.

A.L.W.

A80-12439 Modeling of a thermal wall panel using phase change materials. S. I. Guceri and S. F. Faunce (Delaware, University, Newark, Del.). *Energy* (UK), vol. 4, Aug. 1979, p. 695-699. 8 refs.

This work presents a model for a phase-change material (PCM) thermal wall being tested at the University of Delaware's Solar One House under the auspices of the Institute of Energy Conversion. The PCM is contained in small-diameter tubes with staggered arrangement. Charging of the unit is done during the periods of insolation by using direct solar radiation. The discharge of the unit is provided by air flow across the tube arrangement to carry heat; a computer model is developed to predict the response of the unit during its discharge from a given initial state. The tubes are lumped in groups of three along the air stream. The Biot number is found to be less than 0.1, which indicates that the error associated with lumping is less than 5%. Each bundle of tubes is considered in three distinct regimes: presolidification, solidification, postsolidification. The model developed thus far has been used to predict the time response of the wall panel in satisfactory agreement with the actual performance. The simulation helped to establish the important system parameters.

(Author)

A80-12440 Design criteria in PCM wall thermal storage. A. D. Solomon (Union Carbide Corp., Nuclear Div., Oak Ridge, Tenn.). *Energy* (UK), vol. 4, Aug. 1979, p. 701-709. 15 refs. Contract No. W-7405-eng-26.

Criteria for optimizing the thermal behavior of a wall composed of a phase-change material interspersed in a cementlike structural material are discussed. Results of computer simulations for a particular wall configuration are examined, and the heat-transfer process in such a system is interpreted. Some quantitative relations describing the wall behavior are outlined. The temporal variation of the wall system is considered, and an approximate expression is obtained for the total discharge time for stored latent heat in the wall.

F.G.M.

A80-12453 A simple model describing hydrogen re-cycling in fusion experiments and its influence on discharge behaviour. W. Köppendörfer (EURATOM and Max-Planck-Institut für Plasma-physik, Garching, West Germany). *Nuclear Fusion*, vol. 19, Oct. 1979, p. 1319-1325. 13 refs.

A model first used to describe hydrogen isotope trapping and replacement in the wall of pinch discharges is extended to tokamak discharges including pulsed gas inlet. It calculates the trapped-particle density in the walls versus time as a function of trapping coefficient, replacement cross-section, geometrical factors, particle confinement time and cold-gas influx. The solutions are used to describe the development of the average electron density and yield criteria for the conditions under which the plasma density falls or rises during a discharge. The model also allows a distinction between plasma/limiter and plasma/first-wall interaction. A comparison with measurements from tokamak discharges is made. (Author)

A80-12607 Monitoring of the solar-heated modular homes at Los Alamos. J. C. Hedstrom (California, University, Los Alamos, N. Mex.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 1. Pittsburgh, Pa., Instrument Society of America, 1979, p. 121-126.

On-line performance of an active solar heated Modular Home has been obtained since October, 1976, with a desk top calculator controlled data acquisition system. A second passive heated Modular Home has been installed and is being monitored with the same system to obtain a comparison between the two units. This paper describes the modular homes, the data system and data reduction technique and presents some of the results obtained. (Author)

A80-12608 Heat flow meters for solar system performance monitoring. G. Russell (Conserdyne Corp., Glendale, Calif.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 1. Pittsburgh, Pa., Instrument Society of America, 1979, p. 131-134.

Heat-flow meters for solar heating applications are needed to provide a low-cost verification of the solar system's performance level. Due to the wide variety of temperature and flow conditions encountered in this field, designers should be aware of all the options available to them in order to design flexible, accurate, and economical heat-flow meters. In the present paper, the basic theory of heat flow measurement is outlined, and the types of temperature sensing devices, flow measurement devices, and electronics packages needed to manufacture heat-flow meters that will operate under various temperature and flow conditions are discussed. V.P.

A80-12609 Energy meter for solar air systems. C. B. Winn (Colorado State University, Fort Collins, Colo.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 1. Pittsburgh, Pa., Instrument Society of America, 1979, p. 135-138.

The paper deals with a low-cost energy meter developed for homeowners to determine (without computation) the amount of solar energy being collected. The energy readings are either in British thermal units or kilowatt hours. The display is digital and nonvolatile. The meter takes into account the different air flow rates that occur in air systems, depending on the mode of operation. The power consumption of the meter is negligible. V.P.

A80-12626 Color graphic controls for the solar central receiver test facility. D. M. Darsey (Sandia Laboratories, Albuquerque, N. Mex.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 2.

Pittsburgh, Pa., Instrument Society of America, 1979, p. 345-352. 5 refs. Research supported by the U.S. Department of Energy.

The generalized, programmable graphics-and-image display terminal used at the Sandia central receiver test facility (CRTF) is described. The graphics hardware, integration software, and applica-

tion programs are discussed as they apply to the real-time control and data presentation of the testing facility. The terminal features a single Facility Operator, separated controls for the Facility Operator and Experimenter with common display data, rapid display update without affecting control, and easily read data in engineering units. The flexibility of the display terminal will enable the CRTF to be tailored for new types of tests without changing anything but software of just interacting with a master control system. V.T.

A80-12627 HelioStat Beam Characterization System. E. D. Thalhammer and G. S. Phipps (Sandia Laboratories, Albuquerque, N. Mex.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 2. Pittsburgh, Pa., Instrument Society of America, 1979, p. 353-364. 9 refs.

The Beam Characterization System utilizes video radiometer techniques to quantitatively describe the solar energy projected by a heliostat. This system is designed to evaluate prototype heliostats and to improve the performance of the Central Receiver Test Facility heliostats. The system consists of a beam target, video camera, analog image analyzer, calibration system, video digitizer and a mini-computer system. The calibration technique corrects for background illumination, target irregularities, vidicon shading and camera dark currents. A computer code corrects for off-axis camera angle and converts calibration and beam data into a map of screen irradiance. Post test data analysis provides the geometric centroid, energy versus radius, iso-flux contours, intensity cross sections and 3-D intensity diagrams which are determined from the data map. The system has a fast data capture mode which can be used to study wind loading and short term tracking errors. The capabilities of the Beam Characterization System make it a useful heliostat evaluation tool. (Author)

A80-12628 An overview of Controlled Thermonuclear Research Division control and data acquisition computer usage at the Los Alamos Scientific Laboratory. G. I. Chandler, J. W. Lilberg, K. A. Klare, and R. W. Wilkins (California, University, Los Alamos, N. Mex.). In: International Instrumentation Symposium, 25th, Anaheim, Calif., May 7-10, 1979, Proceedings. Part 2. Pittsburgh, Pa., Instrument Society of America, 1979, p. 365-370. 7 refs.

An overview of the use of computers for data acquisition and control in fusion experiments is presented. Small to medium scale minicomputers interfaced to the experiment through CAMAC modules were used. System shielding and grounding were given special consideration. It is noted that the use of top-down, modular design techniques for both software and hardware increases system reliability and reduces system maintenance effort. The systems discussed can also be used for on-line data analysis and linked to a center where additional off-line analysis can be performed. V.T.

A80-12735 # Area load-frequency control. T. M. Athay, R. G. Smith (Systems Control, Inc., Palo Alto, Calif.), and H. G. Kwatny (Drexel University, Philadelphia, Pa.). In: Annual Allerton Conference on Communication, Control and Computing, 16th, Monticello, Ill., October 4-6, 1978, Proceedings. Urbana, Ill., University of Illinois, 1978, p. 882-893. 12 refs. Contract No. EG-77-01-2118.

Four basic objectives of load-frequency control (LFC) are discussed: (1) total-area generation should be controlled so as to track the area load plus schedule; (2) the individual-unit generations should be controlled so as to track the desired unit economic trajectories; (3) load-frequency control should allow the area primary response to occur naturally; and (4) individual-unit response rate limitations must not be violated. The parallel structure of LFC is exploited by designing independent controllers for each generating unit and a coordinating controller for the control area. These two components of the LFC structure are discussed and evaluated using a combination of the linear-quadratic-Gaussian (LOG) synthesis techniques, linear simulation, and frequency domain analysis. V.T.

A80-12739 **Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.** Convention sponsored by the Solar Energy Society of India, Council of Scientific and Industrial Research, Department of Science and Technology, et al. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979. 742 p. \$30.

The convention focused on solar radiation, photobiology, photochemistry, flat plate collectors, concentrators, solar thermal power and storage, solar water heaters and refrigerators, industrial applications and solar cells. Specifically, papers were presented on energy plantation for the Coromandel littoral, photogalvanic cells, effect of boosters on the flat plate collector performance, transient rise of plate temperature in solar collectors, performance of a high temperature air heater, an investigation of a compound parabolic concentrator, a seasonally adjusted collector made of mirror strips, testing of solar domestic water heaters, utilization of solar energy in dairy processing, design of a solar heated house, solar furnaces in foundries, role of the oxide layer in Schottky barrier solar cells, cadmium telluride solar cells, annealing and degradation studies of ceramic CdS solar cells, solar radiation, an electronic device for intermittent tracking, and performance of solar regenerators. A.T.

A80-12740 # **Solar energy availability over India for maximum utilisation.** H. R. Ganesan (Meteorological Office, Poona, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 1-7.

A80-12742 # **Energy plantation for coromandel littoral.** C. V. Seshadri and G. Venkataramani (Shri A.M.M. Murugappa Chettiar Research Centre, Madras, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 36-40.

The paper considers an energy plantation which grows plants for their fuel value with casuarina as the energy crop. In energy plantations the fuel resource is renewable, fuel transportation is minimal, and forestation conserves soils; however, large areas are needed, and new power plant designs may be required for the new fuel. Using Pondicherry and Madurantakam, India, cultivation practices, cost and energy analyses were performed for setting up a 160 MWe power-plant burning fuel-wood from the casuarina tree. The Pondicherry method using 10,000 trees/ha and producing up to 300 tons/ha in a 4-year cycle appears most suitable, requiring 1.1 sq km per MW. The plantation should be amortized in 5 to 30 years, with the land becoming wholly owned by the plantation at the end of longer periods. It is concluded that energy plantations provide means of generating small amounts of decentralized power for rural use. A.T.

A80-12743 # **Studies of photogalvanic cells.** R. Narayan and M. Subrahmanyam (Indian Institute of Technology, Madras, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 56-59. Research supported by the Department of Science and Technology of India.

An investigation to determine redox couples in combination with platinum and other electrode materials to provide good efficiency and reproducibility is presented. The reasons for poor efficiency are the internal cell resistance, the back reaction, and incorrect pretreatment of electrodes. Platinum gauze and foil, sintered Ta cylinders, Ta plates, stainless steel sheets, and carbon blocks were used as electrodes. Co(2+), Co(3+), and Cr(3+) ions, thionine dyes, and H₂SO₄ and HCl electrolytes were tested, noting that with Co(2+) and thionine in HCl a photogalvanic (pg) potential of -70 to -90 mV was observed with Pt electrodes. With stainless steel plate electrodes about -300 mV pg effect was obtained within two

minutes of illumination, but the current through an 100 ohm resistance was only 20-30 microamperes requiring a modification of the cell geometry and chemistry. A.T.

A80-12744 # **Effect of boosters on the performance of flat plate collector.** P. C. Pande, H. P. Garg, and K. P. Thanvi (Central Arid Zone Research Institute, Jodhpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 61-70. 8 refs.

The effect of boosters (plane reflectors) on the performance of a flat plate collector inclined at an optimum tilt is determined for different seasons. The integrated enhancement in the energy gain by the collector due to boosters is calculated considering variation of transmittance of glass cover with angle of incidence, absorptance by the collector plate, and the total collector area exposed by the reflected radiations. It was found that more solar energy can be collected by adding boosters to the flat plate collector, which will be more effective with a large number of these collectors. During winter, a booster at the top edge of the south facing collector is more effective than that at the bottom edge, while the reverse is true during the summer. An experimental study of the improvement in the performance of a built-in storage type solar water heater by boosters was performed, concluding that available solar radiation should be analyzed in terms of direct and diffuse radiation before using the booster. A.T.

A80-12745 # **Solar energy flat plate collectors - Optimization of air gap.** N. M. Nahar and H. P. Garg (Central Arid Zone Research Institute, Jodhpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 71-78. 13 refs.

Convection losses between the absorber plate and glass cover calculated for various gap sizes and temperatures using previously developed correlations of natural convection in enclosed spaces are examined. The natural convective heat transfer coefficients were developed for horizontal, vertical, and tilted collectors, noting that coefficients decrease and shading on absorber plates due to side walls increases with increasing gap. The shade correction factor was calculated for several optimum tilt values of the collector at low and medium latitude stations. The gap between the absorber and cover glazing was optimized by considering natural convection and shading, concluding that for minimum convection losses and shading a 4 to 5 cm gap should be maintained for efficient use of a solar energy flat plate collector. A.T.

A80-12746 # **Transient rise of plate temperature in solar collectors.** M. S. Sodha, S. C. Kaushik, G. N. Tewari, A. K. Seth (Indian Institute of Technology, New Delhi, India), and M. A. S. Malik (Kuwait Institute of Scientific Research, Kuwait). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 84-87.

A80-12747 # **Optical and electrical investigations on annealed indium oxide selective coatings produced by spray pyrolysis.** A. K. Sharma, B. K. Gupta, S. S. Mathur, and O. P. Agnihotri (Indian Institute of Technology, New Delhi, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 119-121.

A80-12748 # **An investigation of experimental performance of a compound parabolic concentrator.** K. K. Rao (Regional Research Laboratory, Bhuvaneshwar, India), S. B. Ahmed (Corporate R&D BHEL, Hyderabad, India), R. Natarajan, and M. C. Gupta (Indian Institute of Technology, Madras, India). In: Solar energy for

rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 137-141. 5 refs.

An experimental performance of a header-type compound parabolic concentrator (CPC) and a flat-plate collector (FPC) were investigated. Two collector configurations were considered: a collector with the absorber tubes oriented in the east-west direction, and a configuration in which the absorber tubes of the FPC were oriented in the north-south direction. The effects of several fluid flow rates and tilt angles on efficiency and useful thermal energy gain was determined as a function of the hour of the day. The CPC was found to be more efficient than FPC for two hours around noon when the tilt was equal to declination, but the FPC had better over-all performance when the tilt angle was equal to latitude. A.T.

A80-12749 # Performance of solid compound parabolic concentrators in series. R. Kumar, S. B. L. Garg, and R. K. Bhardwaj (Motilal Nehru Regional Engineering College, Allahabad, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 142-147. 5 refs.

The possibility of combining two or three solid compound parabolic concentrators (CPC) one over the other using materials of different refractive indices for collecting radiation at high concentration ratios is investigated. It was found that for the same aperture and concentration ratios, the collecting surface area of a multistage collector is minimized with a substantial saving in overall depth as compared to a single stage CPC above a critical concentration factor. For a satisfactory design, the first stage acceptance angle should be smaller than that of the second stage concentrator, and the divergence angle of a light beam higher than in a single CPC. It is concluded that collectors with more than two-stages have only limited advantages for reasons of absorption and refraction of rays. A.T.

A80-12750 # A seasonally adjusted concentrating collector made of mirror strips. S. C. Mullick and S. K. Nanda (Indian Institute of Technology, New Delhi, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 153-157. 11 refs.

The design and thermal performance of a seasonally adjusted concentrating collector for a tubular absorber with a glass cover, limiting the number of reflections and the incidence angle, are presented. Absorber design is discussed, noting that the angle of incidence on the glass cover can be limited to any desired value for efficient transmission by the proper choice of the ratio of the absorber radius to the glass tube. The sizes of the absorber and the glass tube are computed by thermal network analysis of radiation and convection heat losses from the absorber to the glass cover, and then to the atmosphere: the slope and the width of reflector mirror strips are related to incident rays. Finally, testing of the collector is described, with the optical efficiency determined under steady insolation and minimal heat losses. A.T.

A80-12751 # Selection of working fluids for low temperature solar thermal power cycles. A. Jagannathan and S. G. Kandlikar (Indian Institute of Technology, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 159-165. 10 refs.

The effect of the working fluid properties and the operating temperatures on the Rankine cycle performance and the turbine design in solar thermal power plants is investigated. The saturation curves, specific volume and latent heat, and stability are discussed; the performance of seven working fluids is compared. All the fluids are stable up to 110 C, but acetone is explosive requiring special care in operating a power plant. The vapor after isentropic expansion for

R-11, R-21, methylene chloride and acetone is slightly in the wet region, and steam has the maximum efficiency, but is not recommended for low temperature cycles. However, for high temperature cycles with large power outputs steam is highly suitable. For low temperature cycles, methylene chloride, R-113, R-11, and R-114 are recommended in that order for low power units. For slightly higher temperature cycles and also for medium sized units, methylene chloride is promising and should be experimentally investigated. A.T.

A80-12752 # Prime mover for solar power plant. S. C. Jain (Samrat Ashok Technology Institute, Vidisha, India), A. Jagannathan, and B. S. Jagadish (Indian Institute of Technology, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 166-170.

Design and development of a 5 kW turbine for a solar power plant are presented. The Freon-11 working fluid is used with the operating cycle between 80 and 40 C. Design assumes a flat plate collector system which sets an upper limit to the maximum cycle temperature and restrictions on the working fluid. The turbine wheel blades were produced as integral parts of the wheel disk, and featured enclosure of the high pressure end of bearing and labyrinth sealing on the low pressure side with a provision for a direct drive. The performance test is discussed, noting that the turbine performance depends on the ratio of the blade to fluid velocity, and that an optimum exists for each mass flow rate condition. It is concluded that these initial tests proved the feasibility of turbine design for small outputs of the order of 5 kW at moderate rotational speeds. A.T.

A80-12753 # A parametric study of solar thermal power plant. A. A. Samuel, U. S. P. Shet, K. A. Bhaskaran, and M. C. Gupta (Indian Institute of Technology, Madras, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 171-179.

The solar thermal power plant discussed in this paper consists of four subsystems: collector system, storage system, prime mover, and generator. The paper considers a Rankine cycle engine which has high thermal efficiency, relatively simple mechanical components and acceptability for use over a wide range of powers. Three working fluids (butane, F113 and F114) are selected because of their low boiling point, high molecular weight and positive slope of vapor saturation curve. A parametric study is carried out to shed light on the design of a solar thermal power plant. The results show the effect of mass flow rate of the working fluid turbine inlet temperature and condenser pressure on thermal and cycle efficiencies of solar thermal power plants that use different working fluids. The results point to the great potential of a solar thermal power plant. Power could be derived more efficiently using a double-fluid Rankine cycle with water as the collector fluid and F114 as the working fluid. A double-glazed collector is seen to improve system efficiency by 1% with 4-C increase in optimum collector temperature. S.D.

A80-12754 # Economics of small solar power plants. B. S. Jagadish (Indian Institute of Technology, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 180-185. 15 refs.

The economic parameters of energy conversion using flat plate collector systems in the output range of 5-25 kW (suitable for rural applications) are examined. Both capital cost per installed kW capacity and the cost of energy per kWh are computed. Some ways to make such systems more efficient are discussed. B.J.

A80-12755 # Storage of solar heat by solid-liquid phase change. V. Seeniraj (Government College of Technology, Coimbatore, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December

20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 186-189. 9 refs.

The storage of solar energy using phase change materials possessing high heats of fusion is analyzed for two energy storage and extraction configurations. Solutions for interface movement, temperature drop and surface heat flux for a tube filled with a salt or metal phase change material and immersed in a working fluid environment or a cylindrical phase change material tube through which the working fluid circulates within an inner tube are derived by means of a perturbation analysis using the Stefan number as the perturbation parameter. It is found that the temperature drop across a given frozen layer increases as the Biot number increases, and heat extraction is more efficient at higher Biot numbers. Surface heat flux calculations indicate, however, that small values of the Biot number (less than 1) are more conducive to a steady rate of energy extraction. A.L.W.

A80-12756 # Review of thermal storage materials from the view point of solar energy application. P. C. Pande and H. P. Garg (Central Arid Zone Research Institute, Jodhpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 191-202. 29 refs.

The thermal energy storage and chemical storage of solar energy are reviewed for evaluating the feasibility of its practical utilization in the solar energy devices for agricultural use. Sensible heat and latent heat storage media are considered for high and low thermal storage, and performances of sensible and latent heat materials are compared by investigating their heat capacities, melting points, enthalpies of fusion, densities, stability, corrosion resistance, and thermal conductivities. The hydration-dehydration equilibria are discussed, and storage by inorganic oxide/hydroxide such as $MgO/Mg(OH)_2$ and $CaO/Ca(OH)_2$ is investigated. A.T.

A80-12757 # Electrochemical storage of photovoltaic solar energy. H. Saha (Chloride India, Ltd., Calcutta; Kalyani, University, Kalyani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 209-217.

Characteristics of storage batteries for electrochemical storage of solar energy for a power system for terrestrial applications are reviewed. Various batteries which may be used, such as lithium-sulfur, sodium-sulfur, and zinc-chlorine types, are analyzed and a design procedure developed for the selection of the battery capacity for a given application. The lead-acid battery is the only one that meets the requirements of the Photovoltaic Electric Power System (PEPS) to obtain energy 'on demand'. Results of the field-trial of a solar power system using a lead-acid battery especially developed for this application are reported, and the potential applications of such a solar cell power system in India are reviewed. A.T.

A80-12758 # Testing of three installed solar domestic water heaters. B. Nimmo (University of Petroleum and Minerals, Dhahran, Saudi Arabia), J. Pearce, and W. Clark (Florida Technological University, Orlando, Fla.). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 237-249. 11 refs.

A solar water heating program of testing three installed solar water heaters in Orlando, Fla. is presented. The testing procedure described was applied to the commercially installed units for one week, the results including useful energy provided, hot water load, insolation, collector efficiency, auxiliary energy, and percent of required energy provided by solar power. The importance of the control unit was emphasized in two tests by the fact that heat was occasionally lost to the surroundings from the collectors. Curves of collector efficiency are presented for two collectors, and in one case the present linear best fit curve is compared to the efficiency curve

for a similar collector obtained with NBS procedures. The efficiencies of the collectors are compared, ranging from 30.2 to 42.3%. A.T.

A80-12759 # Design of 1-ton solar operated LiBr-water air-conditioning system with special reference to solar part. H. K. Varma (Roorkee, University, Roorkee, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 325-330.

A80-12760 # Programme and progress of DST sponsored solar photovoltaic work in India. U. Venkateswarlu (Central Electronics, Ltd., Sahibabad, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 427-432.

A80-12761 # Role of oxide layer in Schottky barrier solar cells. N. K. Swami, S. Srivastava, and H. M. Ghule (Birla Institute of Technology and Science, Pilani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 433-435. Research supported by the University Grants Commission.

A80-12762 # Development of space quality silicon solar cells at B.A.R.C. M. K. Gupta, Y. V. Oke, G. Chandran, and S. K. Gupta (Bhabha Atomic Research Centre, Reactor Control Div., Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 436-439.

The paper discusses the fabrication steps, performance and reliability tests, and future programs of space quality silicon solar cells. Solar cell characteristics for short circuit currents, open circuit voltage and efficiency are examined by plotting I-V characteristics using an X-Y recorder under a quartz-iodine lamp. Attention is given to diode characteristics, series resistance, radiation damage, contact adherence and antireflection coating. C.F.W.

A80-12763 # A theoretical method for estimation of power loss due to mismatch in solar cell I-V characteristics. N. Srinivasamurthy, G. Malathi, and R. S. Mathur (Indian Space Research Organization Satellite Centre, Bangalore, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 440-444.

A theoretical approach is presented to compute the power loss of a parallel array connected set of solar cells. The equations for the current and voltage relation of a solar cell is derived, assuming the cell is made up of unit fragment cells. The calculations for a typical solar panel similar to the one that will be used in the Rohini Satellite-1 are also presented. It is concluded that with a power loss of less than 3%, the cell specified can be amply used for the solar panel without a significant overall power loss. C.F.W.

A80-12764 # Effect of concentrated sunlight on the various parameters of the p-n junction solar cell. N. K. Swami and H. M. Ghule (Birla Institute of Technology and Science, Pilani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 445-450. Research supported by the University Grants Commission.

A80-12765 # Cadmium telluride solar cells. V. K. Jain (Solid State Physics Laboratory, Delhi, India) and A. P. Kulshreshtha (Solid State Physics Laboratory, Delhi; Indian Space Research Organization Satellite Centre, Dept. of Space, Bangalore, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 451-461. 17 refs.

Fabrication techniques for CdTe homo- and heterojunction solar cells and modifications to improve their efficiency are presented. CdTe is suitable for solar cell fabrication since it has a direct band gap with a value appropriate for efficient solar energy conversion. Fabrication of CdTe solar cells using thin film deposition and their efficiency are discussed, noting effects of carrier concentration. A critical examination of homo- and heterojunction solar cells was made, but many of the new proposed structures cannot be used due to their high cost. A cost effective sintered pellet technique for CdTe solar cell fabrication was proposed whose efficiency may be slightly lower than that of single crystal solar cells; it produces a polycrystalline CdS ingot, which is sliced for the deposition of p-type CdTe by screen printing process.

A.T.

A80-12766 # Performance studies on uniform illumination type nontracking concentrators. A. Gupta, Mr. Murlidhar, S. Kumar, and V. K. Tewary (Birla Institute of Technology and Science, Pilani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 462-466.

Experimental results are presented on uniform illumination-type nontracking concentrators. Three models were fabricated with half-acceptance angles of 6 and 11.5 deg, using plain and anodized aluminum sheets. Solar cell/photodiode units were used to determine the widthwise uniformity of the concentrators. Results show that uniformity of illumination is obtained within 10 to 12% variation at various times during the operating period.

B.J.

A80-12768 # Theoretical consideration of curve fill factor in solar cells. A. Subrahmanyam, K. K. Mahendra, and A. P. Kulshreshtha (Solid State Physics Laboratory, Delhi; Indian Space Research Organization Satellite Centre, Dept. of Space, Bangalore, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 474-477.

The paper examines theoretical considerations of curve fill factor (CFF) in solar cells. The CFF determines the quality of voltage-current characteristics and the 'figure of merit' of the solar cell, and it is defined as the ratio of the optimum power under matched load conditions to the product of the open circuit voltage and the short circuit current. It was shown that for a silicon solar cell the CFF tends to a maximum value of 0.85 and a minimum of 0.25, and it saturates at around 0.81. Similar calculations can be made for solar cells fabricated with semiconductors other than silicon, but to evaluate the ratio of the short circuit current to the reverse saturation current, parameters such as life time of minority carriers, band gap, absorption coefficient in different spectral regions, and temperature dependence of these parameters need be known.

A.T.

A80-12769 # Experimental study of MOS solar cells under concentration. S. Kar, S. Bhattacharya, and S. Varma (Indian Institute of Technology, Kanpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 478-486.

The electrical characteristics of Schottky Barrier (SB) and MOS solar cells fabricated on n-type Si using Au and Ag as barrier metals were studied under various values of concentration. Current-voltage, diode current-voltage, and capacitance-voltage characteristics were measured, showing that SB and MOS cells perform equally well as

p-n junction solar cells under concentration. Therefore, use of non-tracking type concentrators will reduce the cost of photovoltaic power generation. The open-circuit voltage of these cells increases with concentration, but the increase is limited by a simultaneous rise in the interface state charge, requiring low interface state density cells for use under concentrated light. The fill factor degraded under concentration, but this can be reduced by a suitable design of the front grid contact.

A.T.

A80-12771 # Annealing and degradation studies of ceramic CdS solar cells. H. Saha (Chloride India, Ltd., Calcutta, India), K. Mukhopadhyay, S. Sengupta, and P. Basu (Kalyani, University, Kalyani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 493-500. 6 refs.

Sintered Cu(x)S/CdS solar cells of about 4% efficiency are fabricated by a pressing, sintering and dipping technique. A detailed study of the effect of annealing CdS in different atmospheres (air, nitrogen, and vacuum) on cell performance is reported. The rates of degradation of these annealed cells, at different ambients including vacuum, are also investigated with a view to understanding the mechanism of their degradation. It is observed that in these ceramic cells the principal mechanism of degradation is copper diffusion, which is seen to be partially arrested by proper annealing and partially enhanced by indium diffusion.

(Author)

A80-12772 # Effect of thin oxide layer on the current voltage relations of Schottky barrier solar cells. S. R. Dhariwal, S. B. Sharma (Government College, Ajmer, India), and P. K. Bhatnagar (Delhi, University, Delhi, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 501-505. 11 refs. Research supported by the University Grants Commission.

The discrepancy between the theoretical and experimentally observed optimum thicknesses of an oxide layer placed between the metal and the semiconductor in a Schottky barrier solar cell is explained in terms of the nonuniform deposition of the thin (10 to 30 Å) oxide layer. The Poisson distribution is used to account for the average oxide layer thickness and an expression for the average tunneling thickness is derived which is different from the average oxide layer thickness due to the difference between the tunneling effective electron mass and the free electron mass. In the case of a Au-SiO₂-nSi structure, it is shown that the tunneling effective thickness is always less than the average oxide thickness, and thus the theoretical prediction of 10 Å as an optimum thickness is shown to correspond to the experimentally determined optimum at 20 Å.

A.L.W.

A80-12773 # Techno-economic feasibility analysis of solar cells with and without concentrators for rural lighting. Mr. Mahabala, S. D. Gorkale, R. L. Datta, and K. S. Rao. In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 506-517.

A80-12774 # GaAs-electrolyte photovoltaic cells. U. Sengupta, H. N. Acharya, and D. N. Bose (Indian Institute of Technology, Kharagpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 518-520. 5 refs.

The performance of GaAs-electrolyte heterojunction photovoltaic cells is measured. Single crystal GaAs specimens in contact with various concentrations of NaOH electrolyte in an electrolytic cell using Pt as the counterelectrode were irradiated by a tungsten lamp. The I-V characteristics of the cell indicate the rectifying property of

the junction and a photocurrent in the reverse bias direction is observed. The C-V characteristics indicate the presence of a depletion layer at the surface of the n-type GaAs. An open-circuit voltage of 0.68 V and a short-circuit current density of 0.18 mA/sq cm at 50 mW/sq cm were obtained with 0.1 N NaOH, and power is found to increase with increasing electrolyte concentration. The spectral response to the cell is observed to exhibit a peak at 700 nm, corresponding to an energy of 1.77 eV. It is concluded that further theoretical and experimental investigation of the system is warranted. A.L.W.

A80-12775 # Reliability studies on thin film solar cells for satellite application. N. R. Pillai, M. J. Nair, and M. K. Mukherjee (Indian Space Research Organization Space Centre, Trivandrum, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 521-527.

Studies of vacuum deposition of CdS thin films for use in solar cells for self-healing bulk satellite power-supply systems are discussed. Cell reliability is analyzed in terms of cell-material, substrate, and film reliability. It is shown that the thickness of CdS films has a pronounced effect on both the physical and electrical properties of solar cells, that typical CdS films consist of regions of varying porosity, and that the porosity may explain the necessity of attaining high film reliability in order to fabricate solar cells with an efficiency that is inversely proportional to the number of pores. The effect of such efficiency on overall performance, including the cost aspect of the power system, is considered. It is concluded that a negligible pore effect can be achieved by selecting optimum evaporation parameters for depositing fcc-type CdS thin films on highly reliable substrates. F.G.M.

A80-12776 # Experimental investigation of various barrier metals for Schottky barrier and MOS solar cells. S. Kar, S. Bhattacharya, D. Shanker, and S. Varma (Indian Institute of Technology, Kanpur, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 528-533. 8 refs.

The effect of barrier metals on the performance of Schottky Barrier (SB)/MOS solar cells was investigated. Au, Ag, and Cu were studied for n-type and Al, Cr, and Sn for p-type silicon. Au and Ag films have very high transmission, followed by Cu, Cr, Sn, and Al. A short-circuit current density of 39.5 mA/sq cm was measured in Ag cells, and 36.0 mA/sq cm in Au cells; an open-circuit voltage of 300 mV was obtained in Au cells, 260 mV in Ag cells, and 160 mV in Cu cells on n-type silicon. In comparison, the open-circuit voltage of Au, Ag, and Al MOS cells ranged between 400 and 498 mV with a 22 Å thick oxide. The transmission coefficient T of the thin metal layer was a strong inverse function of the wavelength, but the rate of decrease of T with wavelength varied between metals. A.T.

A80-12777 # Review of the work done at C.E.E.R.I. on the development of single crystal silicon solar cells for use with concentrated light. B. R. Marathe, R. C. Dubey, A. R. Bardhan, H. S. Kothari, K. S. Yadav, V. Holla, N. N. Kundu, D. S. Rao, and S. Chandra (Central Electronics Engineering Research Institute, Pilani, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 534-538. 8 refs. Research sponsored by the Department of Science and Technology.

A80-12778 # Design and development of a 100 peak watt photovoltaic concentrator system. In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar,

India, Central Salt and Marine Chemicals Research Institute, 1979, p. 539-543. Research sponsored by the Department of Science and Technology.

Solar photovoltaic cells for concentrated sunlight are described, which were fabricated using quarters of 50-mm-diameter, p-type silicon single crystal wafers. A one-axis tracking system capable of giving 12 peak watts is analyzed from the point of view of developing larger systems. Consideration is given to a 100 peak watt, two-axes tracking system. Its design is based on the heliostatic structure. This system has the advantage of rotating and supporting the structure along the gravitational axis, which improves its stability. V.T.

A80-12780 # Industrial applications of solar energy in India. B. C. Jain (Jyoti, Ltd., Baroda, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. (A80-12739 02-44) Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 588-594.

A80-12781 # Solar absorption spectra of PbS-Al and PbSe-Al systems. A. Chandra (Ministry of Communications, Betim, Goa, India), A. Varughese (Dhempe College of Arts and Science, Panaji, Goa, India), and A. S. Wagh (Bombay University, Panaji, Goa, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 607-612. 6 refs.

A80-12782 # An electronic device for intermittent tracking. J. T. Eapen (Institute of Science, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 623-628.

Solar collectors must track the sun in order to obtain high efficiency. The paper describes a project intended to design and construct a simple electronic device for intermittent tracking of the sun. The design is based on a light-dependent resistor (LDR) which is the sensor used in the circuit. The LDR has high resistance in the dark, and the resistance decreases with the intensity of the light incident on it. The design and construction of a 'seek and hold' tracking system are described, along with the drive system, operation, and cloud interference control. The tracking system can provide diurnal tracking. The azimuthal tracking (seasonal adjustment) is done by manual adjustment as shown schematically. The device has been constructed and tested, showing that it is suitable for adjusting the solar collector. S.D.

A80-12783 # Study of photochemical processes in the ferrous-thionine system. P. N. Moorthy, S. N. Guha, and P. V. Kamat (Bhabha Atomic Research Centre, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 629-637. 8 refs.

The photogalvanic effect in the ferrous thionine system is affected by a number of factors, including light intensity, type of dye, redox components, pH, presence of organic solvents, types of electrodes, and mechanical agitation of the system. This paper describes a photochemical study designed to examine such influences on the photogalvanic effect in ferrous thionine system. The study involved flash photolysis, kinetic spectrophotometry, spectrofluorimetry, and photoelectrochemical studies. B.J.

A80-12784 # Solar concentrator with polyester film for reflecting surface and pendulum arrangement for tracking movement. C. R. Marathe (Indian Institute of Technology, Bombay, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978. Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 638-643.

A80-12785 # Effect of image force on the characteristics of MOS solar cell. P. K. Bhatnagar (Delhi, University, Delhi, India), S. R. Dhariwal, and S. B. Sharma (Government College, Ajmer, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 670-674. Research supported by the University Grants Commission.

The effect of image force on the carrier of a metal-oxide semiconductor solar cell is studied. The image force lowering of the barrier for different thickness of the oxide layer is calculated. Emphasis is placed on the effect of image force barrier lowering on the I/V characteristics, power, fill-factor, and open circuit voltage of a typical MOS Au-SiO₂-nSi solar cell. V.T.

A80-12786 # Experimental investigations of an intermittent ammonia-water solar refrigerator. A. Venkatesh and M. C. Gupta (Indian Institute of Technology, Madras, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 675-684.

The paper discusses the experimental results of an intermittent ammonia-water solar refrigerator operating with a flat plate collector. Results obtained from experiments conducted in the initial concentration range of 0.5 to 0.65 are compared and discussed. Also, the effects of cooling load, rate of cooling of the absorber and the use of mirror boosters on the performance of the refrigerator are discussed.

(Author)

A80-12787 # Performance characteristics of solar regenerators. P. Gandhidasan, V. Sriramulu, and M. C. Gupta (Indian Institute of Technology, Madras, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 685-690.

The paper deals with the use of solar energy for regenerating absorbent chemical solutions. A method is described where the absorbent solution is made to flow, in the form of a thin film, over a solar collector; the water evaporating from the surface is removed by streaming air. In the forced convection regenerator, the film and the airstream can move in the same direction and in opposed directions. The effectiveness of the equidirectional and counter-flow versions of the solar regenerator is evaluated. The case where the evaporating water is removed by wind gusts is examined. V.P.

A80-12788 # Bogus-type treatment of Cu₂S-CdS solar cells using deposition from solution. S. Deb, M. K. Mukherjee, K. Maitra, and D. Mukherjee (Jadavpur University, Calcutta, India). In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute, 1979, p. 691-696. 6 refs.

The paper reports a method of electrolytic deposition on ceramic Cu₂S-CdS solar cells using junctions on vacuum-annealed ceramic CdS tablets formed by an auto-diffusion technique. The Bogus treatment (1973) consisting of deposition of a thin copper layer by a vacuum technique, followed by a heat treatment to increase the cell efficiency and improve the yield is described. Fabrication of sintered CdS cells and various electroplating conditions of Cu deposition from a CuSO₄ solution are presented. It is suggested that this method improves the curve factor, the short-circuit current, and open circuit cell voltage, and points to the possibility of a simple and inexpensive method of accomplishing the key step in fabrication of Cu₂S/CdS solar cells. A.T.

A80-12789 # Some experimental studies on the technical developments of low cost silicon solar cells. In: Solar energy for rural development; Proceedings of the National Solar Energy Convention, Bhavnagar, India, December 20-22, 1978.

Bhavnagar, India, Central Salt and Marine Chemicals Research Institute,

1979, p. 709-715. Research sponsored by the Department of Science and Technology.

The development of low cost production techniques for contact metallization and anti-reflection coatings is assessed, and a comparative analysis of material cost for vacuum evaporated and screen printed contacts is made. Result of preliminary studies on screen printed contacts, spin-on anti-reflection layers and textured black cells showed that a major cost reduction is possible by employing the described low cost techniques. The results highlight the fact that the introduction of low cost techniques could not only increase the process throughput but also eliminate the use of expensive vacuum evaporation systems. C.F.W.

A80-12815 Power loss in photovoltaic arrays due to mismatch in cell characteristics. L. L. Bucciarelli, Jr. (MIT, Cambridge, Mass.). *Solar Energy*, vol. 23, no. 4, 1979, p. 277-288. Research sponsored by the U.S. Department of Energy.

Variations in the current-voltage characteristics of photovoltaic cells can lead to significant power loss 'due to mismatch' when the cells are connected together in a network. This study explores how this mismatch loss depends on variations in max-power current and max-power voltage from cell to cell. An analysis of a series string is first performed. Losses in a parallel string are also determined. Estimates of mismatch losses in more complex arrays are then obtained. In addition to generally excellent comparison with several numerical studies, results show that, for a series string, there exists a critical magnitude of deviation in cell max-power current beyond which the power loss due to mismatch is sensitive to both the number of cells placed in series and the shape of the probability density function defining variations in max-power current. This critical level also depends on the cell fill-factor. (Author)

A80-12816 * Optimization of multi-layer front-contact grid patterns for solar cells. A. Flat and A. G. Milnes (Carnegie-Mellon University, Pittsburgh, Pa.). *Solar Energy*, vol. 23, no. 4, 1979, p. 289-299. 12 refs. Grant No. NGR-39-087-021.

In a front-contact grid pattern for a solar cell there is a trade-off necessary between shadowing loss and excessive power loss due to voltage drop in the metalization itself. If the metalization is too little there may be excessive contact resistance to the underlying semiconductor and insufficient coverage to control losses in the thin front-surface layer of the solar cell. Optimization of grid pattern area and geometry is considered analytically to minimize total losses. Worthwhile performance advantages are shown to be possible, particularly in concentrator systems, if multi-layer grid patterns are used. The current carrying fingers should be approximately square in metal cross section and the main current feedout bars should not only be wider but also thicker than the primary collecting fingers. This is termed multi-level metalization. Effective use of multi-level grid metalization allows much greater concentration-to-loss ratio for a cell of large area and permits good performance from cells of high front-layer sheet resistance. (Author)

A80-12817 Calculation of monthly mean solar radiation for horizontal and inclined surfaces. J. E. Hay (British Columbia, University, Vancouver, Canada). *Solar Energy*, vol. 23, no. 4, 1979, p. 301-307. 41 refs. Research supported by the British Columbia Energy Commission.

A technique is presented for calculating monthly means of solar radiation for both horizontal and south-facing surfaces. The time scale used is daily totals, and the regression relationship which allows the horizontal surface radiation to be calculated using bright sunshine and surface albedo shows no significant variation between stations or seasons despite the use of data from maritime and continental midlatitude and subarctic locations. The technique presented can therefore be used to establish the long-term solar energy climatology, for both horizontal and south-facing inclined surfaces, over a large geographical area with a wide range of climatic conditions. It is shown that the theoretical and empirical equations normally used on a hourly time scale may be applied to daily data without any significant reduction in the accuracy of the calculated values. S.D.

A80-12819 The turnover times and pool sizes of photo-synthetic hydrogen production by green algae. E. Greenbaum (Union Carbide Corporate Research Laboratory, Tarrytown, N.Y.). *Solar Energy*, vol. 23, no. 4, 1979, p. 315-320. 26 refs. Research supported by the Union Carbide Corp.

An investigation of the turnover times of photobiological production of hydrogen gas by green algae indicate that the photoreactions associated with molecular hydrogen production have promising properties for solar energy conversion and storage. The results indicate that (a) the intrinsic kinetic rate capability of the hydrogen photoapparatus in green algae can keep pace with the incidence rate of light quanta, even in full sunlight; (b) the photogenerated electrons for hydrogen production probably lie in the mainstream of the electron transport chain of photosynthesis. These results have been obtained by performing the first measurements on the turnover times and pool sizes of photosynthetic hydrogen production. Rapid multiple flash experiments have been performed which indicate that the immediate source of reductant for photosynthetic hydrogen production is derived from a pool of 5-20 equivalents, depending on the alga. (Author)

A80-12820 Calculation of climatic solar heating performance. R. H. Bushnell. *Solar Energy*, vol. 23, no. 4, 1979, p. 321-325. 14 refs.

A climatic design method is presented which uses the long-term outdoor temperature distribution as well as utilizability of irradiation to find the solar fraction for building heat. The method considers a solar heater to be able, on the average, to supply all the heat needed by a building down to a cut-in temperature determined by the average amount of solar heat collected and the heat loss coefficient of the building. The amount of auxiliary heat needed is calculated from the kelvin day value below this cut-in temperature. The method permits the use of temperature distributions obtained from long records so that extremes can be represented. This allows calculations to be made near 100% solar heat. Any thermostat setting can be used. Several heat sources can be used. Examples are given. (Author)

A80-12821 Correspondence between solar load ratio method for passive water wall systems and f-Chart performance estimates. M. S. Drew and R. B. G. Selvaie (S-Matrix Enterprises, Ltd., Richmond, British Columbia, Canada). *Solar Energy*, vol. 23, no. 4, 1979, p. 327-331. 5 refs. Research supported by the British Columbia Ministry of Education, Science and Technology.

A simple correspondence is demonstrated between passive solar system performance and active system f-Chart estimates. The equations describing a thermal network model of a passive water wall solar system are compared term by term with similar equations governing the heat balance in an active solar heating system, making possible an identification of appropriate passive system parameters with active system parameters comprising inputs to the f-Chart procedure. Comparisons of f-Chart predictions and results using the Solar Load Ratio method are made for sample cities in sixteen climatic zones. Results indicate a discrepancy of at most about 9 per cent solar fraction between the two methods in the cases studied.

(Author)

A80-12822 An experimental study of corrugated steel sheet solar water heater. S.-A. Wang (Shanghai Mechanical Engineering Institute, Shanghai, Communist China). *Solar Energy*, vol. 23, no. 4, 1979, p. 333-341. 16 refs.

The heat transfer process in a corrugated-steel-sheet solar water heater is analyzed, and an experimental procedure for deriving the collector efficiency equation is proposed. The calculated collector efficiency is greater than 0.94. The temperature is 7 C higher than the collector temperature. V.P.

A80-12823 An incongruent heat-of-fusion system - CaCl₂-6H₂O - made congruent through modification of the chemical composition of the system. B. Carlsson, H. Stymne, and G.

Wettermark (Kungl. Tekniska Hogskolan, Stockholm, Sweden). *Solar Energy*, vol. 23, no. 4, 1979, p. 343-350. 10 refs.

The paper describes a method of ensuring that calcium chloride tetrahydrate is not a stable species in a heat-of-fusion system by chemically modifying it. Thus, an addition of SrCl₂-6H₂O to a CaCl₂-H₂O system decreases the solubility of CaCl₂-6H₂O and increases that of CaCl₂-6H₂O; if the addition of SrCl₂-6H₂O is about 2%, the melting point maximum for CaCl₂-6H₂O coincides with the peritectic point for equilibrium between the hexahydrate, the tetrahydrate, and the solution. With technical grade materials, tetrahydrate is a more severe problem as they contain impurities which have an opposite effect on the CaCl₂ hydrate solubilities to that of SrCl₂-6H₂O. Addition of Ca(OH)₂ suppresses tetrahydrate formation in some cases by neutralizing the excess of the chloride impurity and through formation of the CaCl₂-CaO-2H₂O phase.

A.T.

A80-12824 Truncation of nonimaging cusp concentrators. W. R. McIntire (Argonne National Laboratory, Argonne, Ill.). *Solar Energy*, vol. 23, no. 4, 1979, p. 351-355. 5 refs. Contract No. W-7409-eng-36.

Truncation of nonimaging cusp reflectors which concentrate sunlight onto cylindrical receivers leads to collector designs which are more cost effective through substantial reductions in mirror height and length with small reductions in concentration ratios. In this paper, reflector shapes for truncated nonimaging cusp concentrators having various acceptance angles are presented, as well as curves for height/aperture and mirror arc length/aperture ratios versus concentration ratio. In addition to their general utility in concentrator design, the latter curves have special significance for thermoformed plastic reflector substrates. The reflector height/aperture ratio is the 'draw', and the reflector arc length/aperture ratio is the 'stretch' to which the material is subjected during forming. With this information, important considerations in plastics fabrication can be addressed easily in the early design stages. (Author)

A80-12825 The analysis and simulation of an open cycle absorption refrigeration system. R. K. Collier (California, University, Los Alamos, N. Mex.). *Solar Energy*, vol. 23, no. 4, 1979, p. 357-366. 10 refs. Research sponsored by the U.S. Department of Energy.

An open cycle absorption refrigeration system is simulated and analyzed. The open cycle differs from the closed cycle in that the open cycle regenerates the weak absorbent solution by evaporating refrigerant to the earth's atmosphere rather than to a condenser. The solar collector used for the open cycle is one in which the weak absorbent solution flows as a fluid film over a flat, open, black surface. The absorbent solution is heated by the black surface and is regenerated by water evaporating to the atmosphere. It was found that the relationship between the collector length and the solution mass flow rate was tied to environmental factors such as wind and humidity when optimizing system performance. The system performance was simulated for five cities using actual weather data. The overall daily cooling COP's (cooling/incident solar) ranged from 0.09 to 0.45 for various conditions. (Author)

A80-12835 The scope of effective medium theory for fine metal particle solar absorbers. G. B. Smith (Houston, University, Houston, Tex.; New South Wales Institute of Technology, Broadway, Australia). *Applied Physics Letters*, vol. 35, Nov. 1, 1979, p. 668-670. 12 refs. Research supported by the U.S. Department of Energy and University of Houston.

The treatment of an array of small metal particles as a continuous effective medium is shown to be possible for visible and near-infrared frequencies at much larger particle sizes and separations than often supposed. Specific upper limits are evaluated for chromium. Results are based on the strongly correlated model. For this, the usual topology, variation, and attenuation of the field strength over average unit cell dimensions are permissible, provided such variations are characteristic of the effective medium as a whole. As wavelength decreases, the leading contribution to diffuse scat-

tering off such composite films should come from terms proportional to λ to the -8th power not the Rayleigh term. (Author)

A80-12838 Efficiency of quantum-utilizing solar energy converters in the absence of intraband thermalization. R. T. Ross (Ohio State University, Columbus, Ohio). *Applied Physics Letters*, vol. 35, Nov. 1, 1979, p. 707, 708. 5 refs. Research supported by the U.S. Department of Energy; NSF Grant No. PCM-76-11655.

In some photoelectrical and photochemical devices, energy conversion may occur before thermal equilibrium within the electronic bands of the absorber. A statistical thermodynamic argument shows that such hot-transfer devices cannot have an efficiency greater than that of an ideal device in which thermalization precedes energy conversion. (Author)

A80-12853 A 30-ps Josephson current injection logic /CIL/. T. R. Gheewala (IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y.). *IEEE Journal of Solid-State Circuits*, vol. SC-14, Oct. 1979, p. 787-793. 21 refs.

A family of novel Josephson logic circuits called current injection logic (CIL) is presented. In contrast to previous approaches, it combines magnetically coupled interferometers with novel non-linear injection gates to obtain ultra-fast logic speeds, wide margins, and greater fan-in and fan-out capabilities. Fastest logic delay of 30 ps/gate is measured averaged over two- and four-input OR and AND gates (average fan-in = 4.5, average fan-out = 2.5) fabricated using 2.5 micron nominal design rules. The average power dissipation of these experimental circuits is 6 micron W/gate. An unprecedented logic delay of 13 ps/stage is measured on a chain of two-input OR gates, and the logic delay for a circuit consisting of two two-input OR gates, the outputs of which are 'AND'ed, is measured at 26 ps. The experimental results are found to be in excellent agreement with delay estimates based upon computer simulations. (Author)

A80-12883 # Laser fusion - Energy application perspectives (Lazernyi termoiadernyi sintez - Perspektivy energeticheskikh primeneni). A. V. Kalinin. *Akademiia Nauk SSSR, Izvestiia, Energetika i Transport*, Sept.-Oct. 1979, p. 16-23. 12 refs. In Russian.

The paper presents a brief comparative investigation of different conceptual laser fusion systems. These include: (1) 'pure' laser fusion power plants; (2) hybrid (fusion-fission) plants; (3) laser fusion breeder reactors; and (4) laser fusion devices for the production of nonnuclear fuels. The basic characteristics of these systems are examined. B.J.

A80-12896 # Calculation of the low-frequency electromagnetic field of MHD machines encapsulated in a common screening shell (Raschet nizkochastotnogo elektromagnitnogo polia MGD-mashin v obshchei ekraniruiushchei obolochke). S. M. Apollonskii. *Magnitnaia Gidrodinamika*, July-Sept. 1979, p. 83-86. 5 refs. In Russian.

The paper develops a method for calculating the electromagnetic fields of two or more MHD machines encapsulated in a common housing, with consideration of the mutual field interaction. Some results are presented on the field interaction of two MHD pumps in a common housing, taking into account ferromagnetic and screening effects. B.J.

A80-12897 # Simultaneous investigation of transverse and longitudinal edge effects in the channel of a plane MHD induction pump (Ob odnovernennom uchete poperechnogo i prodol'nogo kraevykh effektiv v kanale ploskogo induktsionnogo MGD-nasosa). L. M. Dronnik, S. Iu. Reutskii, and A. I. El'kin. *Magnitnaia Gidrodinamika*, July-Sept. 1979, p. 87-93. 10 refs. In Russian.

The paper proposes a mathematical model of a plane MHD induction pump that makes it possible to investigate simultaneously longitudinal and transverse edge effects on flow parameters in the channel. An analytical solution is obtained for steady laminar flow in a channel with insulation barriers at the inlet and outlet. It is found that the longitudinal edge effect affects velocity in the central part of the channel, but has no influence on reverse flow at the walls. B.J.

A80-12898 # Conduction-type MHD generator with back-and-forth motion of the hybrid working material (Konduksionnyi MGD-generator s vozvratno-postupatel'nym dvizheniem kombinirovannogo rabochego tela). S. E. Kuznetsov and V. I. Andreev. *Magnitnaia Gidrodinamika*, July-Sept. 1979, p. 97-104. 5 refs. In Russian.

A conduction-type MHD generator with a hybrid working material, liquid metal and a solid conductor (a metallic plate), has been designed in an effort to reduce the total internal resistance of the system. The operating characteristics of an MHD generator with back-and-forth motion of a working material consisting of mercury and a copper plate are analyzed. B.J.

A80-12900 # Determination of the geometry of the transition region of a series MHD generator (Opredelenie geometrii perekhodnogo uchastka seriesnogo MGD-generatora). G. P. Bazarov, E. N. Kufa, and S. A. Medin. *Magnitnaia Gidrodinamika*, July-Sept. 1979, p. 140-142. In Russian.

The paper considers the characteristics of the series channels of a MHD generator for a wide range of loads with zero field strength at connections between channels. Particular attention is given to the effects of the geometry of transition regions between channels on the power output characteristics of the generator. B.J.

A80-12940 # Progress in R and D on coal liquefaction - Progress in research-development on coal liquefaction. S. Hulisz. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 24 p.* 25 refs.

The predictions which may be drawn from the present report indicate that at the turn of this century the production and utilization of petroleum will decrease progressively, whereas coal, the major deposits of which are located in the industrialized portions of the world, will progressively increase in importance as an energy source and as a source of chemical raw materials. Some advantages of the utilization of low-sulfuric oil from coal are noted. V.P.

A80-12941 # The role of coal gasification and liquefaction in improving the efficiency of energy use - Comparative end use efficiency of the use of coal: Substitute natural gas and other gases versus electric power production. H.-D. Schilling. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 13 p.*

A80-12942 # Environmental protection in the processing of coal - The utilization or disposal of coal processing residues. J. S. Harrison. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 14 p.* 54 refs.

All coal processing operations produce residues, either carbonaceous or inorganic. The present paper deals with the problem of finding means of using the residues profitably to help processing economics. The case where processing cost will be increased by the necessity of disposing residues in an environmentally acceptable fashion is also examined. V.P.

A80-12943 # Environmental protection in the processing of coal. J. Nemec. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 8 p.* Translation.

The present report deals with some aspects of air pollution associated with the development of coal gasification and liquefaction techniques. It is based on published data and on experience in the operation of pressurized gasworks in Czechoslovakia. It is shown that the concentration of such harmful substances as dust, fumes, and gaseous emissions (sulfur oxides, carbon, nitrogen, sulfur compounds, arsenic, hydrogen chloride, etc.) emitted in the atmosphere depend on the brand of coal, the conversion technology employed,

the degree of equipment sophistication, and adherence to technological specifications. V.P.

A80-12944 # Coal as a source of chemical raw materials - Prospects for chemical synthesis based on gas from coal. H. Teggers. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 20 p. 13 refs.*

The requirements placed on coal gasification processes suitable for synthesis gas production are reviewed. The Lurgi, Winkler, Koppers-Totzek processes are outlined, and some recently proposed improvements to these processes are noted. The thermal efficiency of each step of methanol production by coal gasification (by the Lurgi process) is studied with a view toward the cost-optimization of the methanol production process. V.P.

A80-12945 # Progress and development trends in coal gasification and liquefaction technologies. A. A. Krichko. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 42 p. Translation.*

In the present paper, methods of converting coal into combustible gases are reviewed with particular reference to the Lurgi process, the Winkler process, and the Koppers-Totzek process. Thermodynamic analysis of the reactions which occur in the reduction zone indicates that by conducting the process of CO₂ and H₂O reduction under equilibrium conditions, the gasification process can be considerably intensified and gas generator capacity can be drastically increased. The mechanisms and kinetics of the principal reactions between carbon and gases are examined. V.P.

A80-12946 # Progress and development trends in coal gasification and liquefaction technologies - New gasification methods developed on a laboratory or large scale. G. Fumich. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 10 p.*

New large-scale and laboratory coal gasification methods are examined. The three stages in gasifier developments, the Lurgi fixed bed reactor, the second generation reactor split into separate sections making it possible to optimize each section, and the third generation hydrolysis reactor which reacts the coal with pure hydrogen to produce only methane are described. The review of the evolution of gasifier and gasification process is made considering electrofluid reactors, fluidization, slagging, hydrogasification, and the flash hydrolysis catalytic method. Fluidization provides good gas-solids contacting, heat transfer, and uniform temperatures; slagging gasifiers are suitable for a wide range of products from synthesis gas to processing coal liquefaction residues; and flash hydrolysis gasifier features effective single-element injector scaling and a minimization of the H₂/coal ratio. A.T.

A80-12947 # Progress and development trends in coal gasification and liquefaction technologies - Recent achievements in conventional coal gasification processes. H. J. F. Stroud. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 18 p. 13 refs.*

In the present report, some recent developments in the technology of coal gasification, using conventional processes, or a modern variant developed directly from them, are reviewed. Particular attention is given to fixed-bed gasifiers, the Lurgi process, and to advances made in Czechoslovakia and India. V.P.

A80-12948 # Progress and development trends in coal gasification and liquefaction technologies - Underground coal gasification. P. Ledent. *U.N. Economic Commission for Europe, Symposium on the Gasification and Liquefaction of Coal, Katowice, Poland, Apr. 23-27, 1979, Paper. 17 p. 26 refs. Translation.*

Development trends in underground coal gasification are presented. Current methods being tested including the percolation

method for horizontal deposits and drilling in steeply inclined seams are described; technical problems of lining between bore-holes, ground subsidence, and water intrusions are considered. Improved control of the advance of the gasification front by use of high pressure air and gasification of deep deposits by compressed air pressure are discussed, noting that operation at great depth has advantages of absence of air leakages and of not interfering with surface aquifers. Economic studies made in U.K., U.S., and Belgium are presented, concluding that this method may produce large amounts of energy at competitive prices and provide lean gas for power stations, synthesis gas for chemical plants, and replace natural gas in distribution networks. A.T.

A80-12964 Laboratory evaluation of two laser fluorosensor systems. G. A. Capelle and L. A. Franks (EG & G Corp., Advanced Measurements Group, Goleta, Calif.). *Applied Optics*, vol. 18, Nov. 1, 1979, p. 3579-3586. 11 refs. Research sponsored by the U.S. Department of Energy.

The characteristics and capabilities of two laboratory versions of a fluorosensor system built around N₂ and KrF lasers are compared. Both systems were tested to determine the feasibility of remotely detecting the fluorescent emission of organic effluents associated with coal processing. System performance was measured under daylight and nighttime conditions for both actual effluents and known reference solutions and is predicted for an airborne system. Experiments on a multichannel system are also described. (Author)

A80-13003 Development of a sodium/sulphur battery for rail applications. M. D. Hames and J. L. Sudworth (British Railways, Technical Centre, Derby, England). *Institution of Electrical Engineers, Proceedings*, vol. 126, Nov. 1979, p. 1157-1161. 12 refs. Research supported by the Department of Transport/Department of the Environment.

The energy and power requirements of sodium/sulphur batteries to meet three different rail-traction applications are considered. Cell design options to meet these requirements are discussed briefly, and it can be shown that the central-sulphur tube-cell design can meet the requirements of the three rail-traction applications. The design features of a central-sulphur cell design are discussed and data are presented to indicate the state of cell development in terms of cell performance, reliability reproducibility and safety. The electrical properties of cells connected in series/parallel arrays for battery operation are discussed, together with battery thermal management and safety. A practical 10KWh battery comprising 176 cells connected as two 11 x 8 series-parallel arrays has been tested, and problems which can arise from overdischarge, thermal management and electrical short circuits are discussed. (Author)

A80-13004 Wind energy conversion system with electromagnetic stabiliser. M. Kant, M. Berna (Compiègne, Université de Technologie, Compiègne, France), and E. Vidoni (Paris, Laboratoire de Génie Electrique, Fontenay-aux-Roses, Hauts-de-Seine, France). *Institution of Electrical Engineers, Proceedings*, vol. 126, Nov. 1979, p. 1201-1203.

Development of a wind-energy conversion system unit, consisting of a constant-pitch double-blade rigid rotor, electromagnetic brake, and two-stage generator, is considered. The first-stage output is used to actuate the brake, and the second stage produces electric power for utilities. Three types of bipolar machines were studied: (1) an armature-semiexcited dc generator, (2) a double-winding dc generator, and (3) a three-phase asynchronous ac generator with an asymmetric secondary. It is noted that such systems eliminate variable-pitch equipment, simplify output voltage control, and can be completed by incorporating an anemometer and gearbox. V.T.

A80-13011 A pistonless Stirling engine - The traveling wave heat engine. P. H. Ceperley (George Mason University, Fairfax, Va.). *Acoustical Society of America, Journal*, vol. 66, Nov. 1979, p. 1508-1513. 9 refs.

The propagation of acoustical waves through a differentially heated regenerator results in gas in the regenerator undergoing a Stirling thermodynamic cycle. One direction of wave propagation results in amplification of the waves and conversion of thermal energy into acoustical energy. The opposite direction results in acoustical energy being used to pump heat. The ideal gain and maximum energy conversion rates are derived in this paper. Low power gain measurements were made which verify the derived gain equation. Practical engines and heat pumps using this principle are discussed. (Author)

A80-13024 # The possibilities of increasing gas turbine efficiency (Die Möglichkeiten zur Verbesserung des Wirkungsgrades der Gasturbinen). F. Toth. *Acta Technica*, vol. 87, no. 3-4, 1978, p. 347-354. In German.

The most efficient cycle for a gas turbine, under conditions when all efficiency parameters are uniform, is determined. It turns out to be the open cycle consisting successively of adiabatic compression, heat uptake at a constant volume, and adiabatic expansion. An attempt is made to determine which of the existing heat engines could best approximate this maximum efficiency cycle, and what sort of gas turbine might enable a more efficient cycle. B.J.

A80-13109 Hydrogen evolution from water using solid carbon and light energy. T. Kawai and T. Sakata (Institute for Molecular Science, Okazaki, Japan). *Nature*, vol. 282, Nov. 15, 1979, p. 283, 284. 6 refs.

Hydrogen production in the light-mediated decomposition of water vapor in the presence of solid carbon is reported. Three mg of active carbon, together with 30 mg of TiO₂ and 10 mg of RuO₂ powder were illuminated in the presence of water vapor by a 500-W mercury lamp. Mass spectrometer analysis of the gas evolved reveals the production a nonflammable mixture of H₂, CO₂ and CO in the presence of the TiO₂/RuO₂ catalyst. Experiments with a regenerative TiO₂/metal oxide catalyst at 80 C resulted in a greater yield of CO and CO₂ than at 60 C, indicating the usefulness of a combination of solar light and thermal energy. The decomposition of water by solar energy in the presence of carbon is suggested as a means of coal gasification and hydrogen production. A.L.W.

A80-13116 * # Aeroelastic stability and response of horizontal axis wind turbine blades. S. B. R. Kottapalli, P. P. Friedmann (California, University, Los Angeles, Calif.), and A. Rosen (Technion - Israel Institute of Technology, Haifa, Israel). *AIAA Journal*, vol. 17, Dec. 1979, p. 1381-1389. 29 refs. Grant No. NSG-3082.

Coupled flap-lag-torsion equations of motion of an isolated horizontal axis wind turbine (HAWT) blade have been formulated. The analysis neglects blade-tower coupling. The final nonlinear equations have periodic coefficients. A new and convenient method of generating an appropriate time-dependent equilibrium position, required for the stability analysis, has been implemented and found to be computationally efficient. Steady-state response and stability boundaries for an existing (typical) HAWT blade are presented. Such stability boundaries have never been published in the literature. The results show that the isolated blade under study is basically stable. The tower shadow (wake) has a considerable effect on the out-of-plane response but leaves blade stability unchanged. Nonlinear terms can significantly affect linearized stability boundaries; however, they have a negligible effect on response, thus implying that a time-dependent equilibrium position (or steady-state response), based completely on the linear system, is appropriate for the type of HAWT blades under study. (Author)

A80-13174 The financing problems of Europe's gas industry (Les problèmes de financement de l'industrie gazière européenne). F. Gläser (Rheinische Energie AG, Cologne, West Germany). *Revue de l'Energie*, vol. 30, Oct. 1979, p. 828-831. In French.

This article aims to draw attention to several important points concerning the development of Europe's gas industry. It especially

aims at examining this problem from the financial angle, that is in relation to the money markets of the various countries. The problem is to determine whether certain factors in the money markets could constitute great obstacles for the development of Europe's gas industry. (Author)

A80-13175 The European economic community's policy concerning natural gas, coal and new sources of energy (La politique de la communauté économique européenne en matière de gaz naturel, de charbon et d'énergies nouvelles). I. Weiss and R. Constans. *Revue de l'Energie*, vol. 30, Oct. 1979, p. 837-843. In French.

This article is a history of the European Community's policy concerning energy. It retraces the birth of cooperation between member-states concerning natural gas, coal and new forms of energy. Concerning natural gas, the author concludes by noting that it is a flexible and nonpolluting energy and has obvious safety advantages. Concerning coal, following a temporary reduction in use, it will most probably once again become one of the main bases of world and European industry. New energies only seem to have a minor impact on the total of energy used by the member-states in a projection to 1990, but these new energies are likely to open promising perspectives for the beginning of the 21st Century. (Author)

A80-13180 SSPS project - Two solar power plants in Spain (Projekt SSPS - Zwei Sonnenkraftwerke in Spanien). H. Elgering (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Bereich für Projektträgerschaften, Cologne, West Germany). *DFVLR-Nachrichten*, Nov. 1979, p. 15-17. In German.

The paper surveys the layout of the planned small solar power systems to be built by the IEA near the Costa del Sol in Spain. When completed the project will supply electrical power to the Spanish power grid, although the main purpose is to gain experience in the construction, design, and operation of solar power plants. The systems proposed will operate on the same principle in which solar heat is transferred to a heat transfer medium such as steam, gas, oil, or sodium. Two arrangements are discussed: the solar tower type and the solar farm type. The latter will utilize collectors of which one type will be adjustable only in elevation and the other in elevation and azimuth. It is concluded that if solar power plants are to be cost effective when fossil fuelled plants no longer are, then development work must begin now. M.E.P.

A80-13195 The R&D programme of the European communities in the field of hydrogen - Progress and results. G. Imarisio (Commission of the European Communities, Brussels, Belgium). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 371-375. 9 refs.

A80-13196 Water splitting reaction on a polynaphthoquinone catalyst - A polynaphthoquinone-So₂-I₂ system for H₂O decomposition. Y. Iwasawa, T. Takeo, and S. Ogasawara (Yokohama National University, Yokohama, Japan). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 377-384. 13 refs.

A80-13197 Microbial hydrogen production from replenishable resources. J. E. Zajic, A. Margaritis, and J. D. Brosseau (Western Ontario, University, London, Canada). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 385-402. 104 refs.

Fossil fuels such as oil, natural gas and coal represent nonreplenishable natural sources and their cost is rapidly escalating as the world energy demand keeps increasing due to population growth and technological development. Hydrogen is an important alternative fuel source which represents a highly efficient energy carrier, and compares favorably with other fuels available today. The paper reviews microbial energy production, microbial oxidation, microbial production of hydrogen, effect of nitrogenase on hydrogen synthesis, and photosynthetic bacteria. Hydrogen produced by a wide variety of microbial systems can be developed into an important alternative energy and chemical resource. Carbohydrates, such as cellulose and

starches, represent an enormous reservoir of replenishable raw materials which have the potential of being converted biochemically to hydrogen gas and other valuable intermediates by a wide variety of microorganisms. S.D.

A80-13198 **Photophysical and chemical processes affecting the stability of the thiazine dye-iron system.** S. Solar and N. Getoff (Wien, Universität, Vienna, Austria). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 403-410. 21 refs. Research supported by the Österreichischer Fonds zur Förderung der wissenschaftlichen Forschung, Bundesministerium für Wissenschaft und Forschung, and Ludwig Boltzmann Gesellschaft.

Photoelectrochemical devices can be used to produce hydrogen under suitable conditions. Although the thiazine dye-iron system has been widely investigated since its introduction by Rabinowitch (1940) as a photogalvanic cell, its application for utilization of solar energy on a large scale is not realized as yet. The paper discusses some of the photophysical and chemical processes which affect the instability of this system. Various experimental techniques are employed to elucidate the reasons for the instability of the thiazine dye-iron system. Conditions under which hydrogen is formed are established. Based on the hydrogen yield, it is possible to calculate the total quantum yield of the energy transfer process. Pulse radiolysis experiments show that the H atoms can attack the dye molecule at various positions, with definite rate constants. The results indicate that the formation of H atoms as a result of a specified reaction and their further reactions with the dye limit the chemical stability of the thiazine dye-iron system. S.D.

A80-13199 **Hydrogen-powered vs. battery-powered automobiles.** J. J. Donnelly, Jr., W. C. Greayer, R. J. Nichols (Aerospace Corp., El Segundo, Calif.), W. J. D. Escher (Escher Technology Associates, St. Johns, Mich.), and E. E. Ecklund (U.S. Department of Energy, Washington, D.C.). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 411-443. 33 refs.

Two future candidate automobile propulsion systems which do not rely upon petroleum or natural gas as an energy source have been studied and the resultant vehicle characteristics identified. The first vehicle system employs a gaseous hydrogen-fueled internal combustion engine (ICE) and either a liquid or metal hydride energy storage system. The second vehicle system employs an electronically controlled electric motor power-train and a battery energy storage system. Major tasks included in this study were the technical and economic assessments of the state of the art and future alternatives in hydrogen production and delivery, the hydrogen vehicle assessment, the battery-electric vehicle assessment and the comparison of the principal vehicle alternative in 1985, 1990 and 2000. The comparison includes weight, size, cost, energy and design range relationships and the implications on expenditure of all major energy sources. The study is summarized, results presented and conclusions drawn. Comments are made on the future roles of hydrogen and electricity in automobile propulsion. (Author)

A80-13200 **Thermodynamic and structural properties of LaNi_{5-y}Al_y compounds and their related hydrides.** H. Diaz, A. Percheron-Guégan, J. C. Achard (CNRS, Meudon, Hauts-de-Seine, France), C. Chatillon, and J. C. Mathieu (Grenoble, Ecole Nationale Supérieure d'Electrochimie et d'Electrometallurgie, Saint-Martin-d'Hères, Isère, France). *International Journal of Hydrogen Energy*, vol. 4, no. 5, 1979, p. 445-454. 25 refs.

Hydrogen is known to react reversibly with intermetallic LaNi₅ type compounds to give hydrides in such temperature, pressure, and kinetics conditions that they are considered very suitable for hydrogen storage either in a solid-gas reaction or in an electrochemical reaction. The paper is concerned with replacing a fraction of nickel by aluminum in LaN(5-y)Al_y compounds, with y increasing from 0 to 1.5 by 0.25 intervals. Al is chosen because it is cheaper and lighter than Ni and has properties very different from those of a transition metal, namely larger atomic radius, valence plus 3 and hydrogen affinity; this can lead to interesting changes in the structural and thermodynamic properties. Results are presented on

the metallurgical, structural and thermodynamic properties of LaNi(5-y)Al_y compounds and their related hydrides. Attention is given to an experimental determination of the enthalpies of formation of LaNi₅ and LaNi₄Al compounds. Correlations are established between structural and thermodynamic properties of intermetallic compounds of the series considered and their related hydrides. S.D.

A80-13204 **Copper diffusion and photovoltaic mechanisms at Cu-CdS contact.** B. Lepley, P. H. Nguyen, C. Boutrix, and S. Ravelet (Nancy, Institut des Sciences de l'Ingénieur, Vandœuvre-lès-Nancy, Meurthe-et-Moselle, France). *Journal of Physics D - Applied Physics*, vol. 12, Nov. 14, 1979, p. 1917-1928. 21 refs.

Schottky barriers have been formed by vacuum evaporation of Cu on to CdS thin films. The behavior of these samples has been investigated as a function of time and annealing by standard electrical methods: current-voltage analysis, capacitance-voltage analysis and analysis of the spectral dependence of the photoemission current. The impurity profile deduced from the reverse differential capacitance shows evidence of copper diffusion occurring between 20 and 200 °C. An activation energy of 0.72 eV is found for the temperature dependence of the diffusion coefficient. The Cu-CdS interface has also been investigated by looking at the photovoltaic mechanisms in connection with the different heat treatments. Capacitance measurements performed under junction illumination have been used to obtain the true donor density after copper diffusion. (Author)

A80-13211 **Autonomous power supplies for telecommunications (Sources d'énergie autonomes pour télécommunications).** J. Auzilleau. *L'Onde Electrique*, vol. 59, Oct. 1979, p. 79-83. In French.

The operational principles of autonomous power supplies for telecommunications equipment, particularly radio relay stations, are considered, and the experimental solar- and wind-powered Aerosolec station is presented. Highly reliable, permanent telecommunications power supplies, often located in remote regions, are described as consisting of one or a number of types of energy sources connected in parallel, complemented by normal and emergency batteries. Aerosolec is composed of a 1100-W solar generator, a 300-W wind generator and normal and emergency batteries ensuring 12-day autonomy in the absence of sun and wind, delivering a permanent power of 180 W. Comparisons of investments costs per watt and per kWh over a 20-year period are presented which indicate the lower cost of wind-power technology. It is concluded that autonomous power supplies in telecommunications represent an advantage, especially in light of future utility limitations. A.L.W.

A80-13223 * **Fuel cell sesquicentennial.** E. M. Cohn (NASA; U.S. Army, Army Research Office, Washington, D.C.). *Energy*, vol. 4, Fall 1979, p. 13, 30.

The development of fuel cell technology is summarized, and the potential for utility-type fuel cell installations is assessed on the occasion of the 150th anniversary of the construction of the first fuel cell by Sir William Grove. The only functional fuel-cell systems developed to date, the hydrogen-oxygen cells used by NASA, are indicated, and hydrazine and alcohol (methanol) cells are considered. Areas requiring development before the implementation of fuel cells as general purpose utility-type electric generators include catalysts for naturally occurring hydrocarbons or processes for low-cost methanol or hydrazine production, efficient means of scrubbing and enriching air, self-regulating systems, and 15- to 20-fold power density increases. It is argued that although ideas for eliminating certain of the above-mentioned problems have been proposed, fuel-cell systems can never be expected to equal the efficiency, reliability and low cost of conventional power plants, and thus developmental support should be discontinued. A.L.W.

A80-13224 **Methanol from coal - An adaption from the past.** E. E. Bailey (Davy McKee Corp., Cleveland, Ohio). *Energy*, vol. 4, Fall 1979, p. 19, 20.

The production of methanol from coal using existing commercially available processing technology is examined for the example of a self-contained plant importing only coal, water and a small amount of power and located adjacent to a Wyoming mine site. Coal from the mine is crushed and dried to 8% moisture, then sent to a fluidized bed gasifier which produces H_2 , CO , CO_2 , methane and inert material from subbituminous coal. The hot gas is treated to ensure the proper H_2 to CO ratio and remove sulfur and excess CO_2 , and is compressed in a methanol synthesis loop in order to produce a total of 7050 tons/day of methanol and 35 liquid tons/day of byproduct sulfur. The overall plant thermal efficiency is 46.5 %, and graphs of the cost of methanol as a function of the cost of coal are presented which indicate the greater sensitivity of methanol prices to capital costs than to plant efficiency. A.L.W.

A80-13225 Gasoline's alternatives are feasible. J. T. Miskell. *Energy*, vol. 4, Fall 1979, p. 22-24.

Various alternatives to petroleum-derived gasoline for use as automobile fuels are discussed. Results of a recent American Gas Association study which indicate substantial cost savings (with costs comparable to gasoline) to be obtained with coal-derived methane gas as compared with synthetic gasoline derived from coal or shale oil or with electricity are presented. The major features of gasoline, natural gas and electric automobiles are compared, noting similarities between gasoline and natural gas vehicles, and hydrocarbon and sulfur oxide emissions in fuel processing and utilization are compared for electric, coal gas, coal gasoline, shale oil gasoline, natural gas and conventional gasoline vehicles. Limitations on the use of methane-fuelled vehicles, including current conversion costs and the lack of a fuel distribution system, are indicated. A.L.W.

A80-13342 Review of tokamak experiments. R. J. Bickerton (EURATOM and Atomic Energy Research Establishment, Culham Laboratory, Abingdon, Oxon, England). In: *Theory of magnetically confined plasmas*; Proceedings of the Course, Varenna, Italy, September 1-10, 1977. Oxford, Pergamon Press, Ltd., 1979, p. 423-491. 35 refs.

A brief description of the history and evolution of the tokamak is followed by a review of the results of tokamak experiments. The topics covered include plasma measurements, coarse confinement and scaling, plasma equilibrium fluctuations in tokamak plasmas, impurities, recycling, plasma/wall interactions, tokamak modes of operation, energy balance, and auxiliary heating. Directions for future experimental work are outlined. V.P.

A80-13513 Energy-storage systems. F. R. Kalhammer (Electric Power Research Institute, Palo Alto, Calif.). *Scientific American*, vol. 241, Dec. 1979, p. 56-65.

Energy storage may play an important role in any shift towards increased use of coal, uranium, or solar energy. Prospects for energy storage by electric power systems, as well as in cars and commercial and residential structures are explored, including pumped-storage hydroelectric plants (one at Ludington, Michigan generates 2,000 megawatts at full power), compressed air (now successfully operational in Huntorf, West Germany), rechargeable batteries (such as lead-acid, nickel-iron, nickel-zinc, zinc-chlorine, sodium-sulfur, and lithium-iron sulfide types), and stored hot water. Pumped-storage hydroelectric plants (raised water) present topographic and environmental constraints, but underground storage is under study. Compressed air is more convenient to store, but requires cooling and then reheating for expansion into turbines. Vehicles powered by batteries, while economically feasible, have as a drawback limited range, and the idea of stored hot water, while gaining ground in Europe, faces in the United States institutional, rather than technical or economic, barriers to its use. J.B.

A80-13589 The helium question. E. Cook (Texas A & M University, College Station, Tex.). *Science*, vol. 206, Dec. 7, 1979, p. 1141-1147. 29 refs.

The question of the desirability of a governmental program of recovering and storing helium from helium-rich natural gas for the

low-cost supply of future helium demands is considered. The geologic occurrence and distribution of helium, most of which is found in the United States, are discussed, and difficulties in the assessment of helium resources are presented. Uncertainties of future large-scale demand for helium for such applications as fusion reactor magnetic confinement systems, refrigeration systems, and low-temperature energy transmission distribution and storage, which will not become operative until well into the next century, are assessed. Past helium conservation activities are reviewed, taking into account the introduction and subsequent suspension of the 1950 Helium Act Amendments. The present-value criterion of helium storage and the conservation approach are outlined, and it is concluded that a future decision to resume storing helium will be based more on prevailing ideas of fairness in intergenerational risk-bearing and equity, and on current views of the qualitative impact on future society of materials scarcities, than on any quantitative forecasts of future needs and costs. A.L.W.

A80-13861 Semiconductor alternating-current motor drives and energy conservation. D. J. BenDaniel (Exxon Enterprises, Inc., Woburn, Mass.) and E. E. David, Jr. (Exxon Research and Engineering Co., Florham Park, N.J.). *Science*, vol. 206, Nov. 16, 1979, p. 773-776. 8 refs.

Energy conservation by means of semiconductor alternating-current control of electric motor drives used in variable-rate industrial processes is presented and applications of the concept are discussed. The need for electrical energy conservation in the process industrial sector is pointed out for the case of drives used to operate industrial pumps, compressors, fans and blowers which typically involve ac electric motors controlled by throttling systems which dissipate excess motor energy. The electronic variable-speed drive is presented as an alternative to throttle control which varies the voltage and frequency simultaneously using a power inverter to achieve energy savings of up to 50% or more. The fully transistorized ac synthesizer (ACS), which represents an improvement in terms of efficiency, wave form quality, size, reliability and cost over previous silicon-controlled rectifier-based variable speed drives, is introduced and energy savings achieved with the ACS in a refinery pump are reported. Other possible applications of the ACS in high-frequency motors, as well as utility power converters and inverters and the integration of alternative electrical energy supplies into conventional power networks are indicated. A.L.W.

A80-13863 Gasohol - Does it or doesn't it produce positive net energy. R. S. Chambers, R. A. Herendeen, J. J. Joyce, and P. S. Penner (Illinois, University, Urbana, Ill.). *Science*, vol. 206, Nov. 16, 1979, p. 789-795. 41 refs.

A detailed analysis of energy inputs and outputs is performed on grain-based gasohol (10 percent grain-based ethanol, 90 percent gasoline). Existing differences of opinion on the energy balance derive mainly from variations in interpretation which are several examples of inherent methodological problems in energy analysis. The result is strongly dependent on assumptions about use of crop residues for fuel and the miles-per-gallon rating of gasohol. In terms of total nonrenewable energy, gasohol is close to the energy break-even point. On the other hand, in terms of petroleum or petroleum-substitutable energy, gasohol is an unambiguous energy producer, since most energy inputs to the process can be supplied by nonpetroleum sources such as coal. (Author)

A80-13980 Textured silicon - A selective absorber for solar thermal conversion. J. I. Gittleman, E. K. Sichel (RCA Laboratories, Princeton, N.J.), H. W. Lehmann, and R. Widmer (RCA Laboratories, Zurich, Switzerland). *Applied Physics Letters*, vol. 35, Nov. 15, 1979, p. 742-744. 10 refs.

Reactive sputter etching has been used to texture the surface of Si wafers. The texturing was in the form of pillars whose diameters and spacing were small compared with the useful solar wavelengths and whose heights were comparable with or larger than these wavelengths. The normal and hemispherical reflectances of textured wafers were measured. The solar absorptance was found to be 0.99 for wavelengths below 1.0 micron. Because of the sharp drop in

absorptance for photon energies less than the energy gap, the overall solar absorptance was about 0.85. The calculated thermal emittance was about 0.25 and was primarily due to multiphoton absorption processes normally observed in thick Si crystals. Much smaller values of thermal emittance would be obtained from thin textured films.

(Author)

A80-13986 Efficient shallow-homojunction GaAs solar cells by molecular beam epitaxy. J. C. C. Fan, A. R. Calawa, R. L. Chapman, and G. W. Turner (MIT, Lexington, Mass.). *Applied Physics Letters*, vol. 35, Nov. 15, 1979, p. 804-806. 11 refs. USAF-sponsored research.

The paper reports that conversion efficiencies of up to 16% at AM1 have been obtained for molecular beam epitaxy (MBE) GaAs solar cells utilizing a shallow-homojunction $n(+)/p/p(+)$ structure without a GaAlAs window. It is reported that the $n(+)$, p , and $p(+)$ GaAs layers were all grown by MBE on single-crystal $p(+)$ GaAs substrates. In addition, cell metallization was performed by electroplating, and an antireflection coating was formed by anodic oxidation of the $n(+)$ layer. In conclusion it is noted that these cells are the first efficient MBE solar cells of any type to be reported.

M.E.P.

A80-14409 Flat-plate solar collector materials. M. L. Day (Ford Aerospace and Communications Co., Palo Alto, Calif.), D. S. Remer, and D. Hyatt. *SAMPE Quarterly*, vol. 11, Nov. 1979, p. 28-37. 10 refs. Research supported by the Southern California Gas Co.

The desirability of specific materials and designs for conventional flat-plate solar collector components is considered. Then a methodology for choosing the most economic component is presented, consisting of a computer simulation and a rate-of-return analysis. The effect of rising conventional fuel costs is examined. Examples of using the methodology are given, based on Southern California climatic and user-demand conditions. Selective absorber-plate coatings and film inner glazing are shown to be economic, yielding a rate-of-return of 23% and 29%, respectively. (Author)

A80-14430 Effect of microwave radiation on the voltage-current characteristics of a variable-thickness Josephson microbridge. V. N. Gubankov, V. P. Koshelets, and G. A. Ovsianikov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). (*Zhurnal Tekhnicheskoi Fiziki*, vol. 49, Apr. 1979, p. 832-838.) *Soviet Physics - Technical Physics*, vol. 24, Apr. 1979, p. 481-485. 14 refs. Translation.

The paper examines data on the temperature and field dependences of the photodetection response (in narrowband and broadband detection modes) of thin-film Josephson microbridges subjected to centimeter-wave and millimeter-wave radiation. The effects of superconductivity induced in the bridges by microwave radiation and by dc current upon the response is considered. Operation in the heterodyne detection mode eliminates these effects and leads to an increase in the differential resistance of the bridges. B.J.

A80-14516 Heat transfer in the channel of a high-power MHD generator. L. M. Biberman, M. B. Zhelezniak, V. N. Zatepin, G. A. Liubimov, S. A. Medin, and A. Kh. Mnatsakanian. (*Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, May-June 1979, p. 136-149.) *Fluid Dynamics*, vol. 14, no. 3, Nov. 1979, p. 434-445. 23 refs. Translation.

The present analysis deals with a linear conduction-type open-cycle MHD generator, employing the combustion products of natural gas in oxygen-enriched air as the working medium. An approximate method (first-approximation) is proposed for calculating the MHD flow and the radiative-convective heat transfer in the generator channel. The method takes the influence of a readily ionizable admixture into consideration. V.P.

A80-14530 Some problems with variable operation of an MHD generator. V. V. Velikov, V. V. Breev, A. V. Gubarev, and A.

V. Zotov. (*Magnitnaia Gidrodinamika*, Jan.-Mar. 1979, p. 89-96.) *Magnetohydrodynamics*, vol. 15, no. 1, July 1979, p. 73-79. 5 refs. Translation.

Some of the variable operating regimes of MHD generators of independent, parallel, and series excitation are characterized. For parallel and series excitations, the current-voltage characteristics are given, and the limiting values of certain characteristics are computed. The variation of parameters along the length of the duct is established for normal and anomalous duct current regimes as the counterpressure in a supersonic generator increases. A plot of the transient regimes of a generator with series connection of the magnetic coil is constructed. P.T.H.

A80-14588 Evaluation of sintered SiC as an electrode and container material in sodium/sulfur cells. R. R. Dubin and S. Prochazka (GE Corporate Research and Development Center, Schenectady, N.Y.). *Electrochemical Society, Journal*, vol. 126, Dec. 1979, p. 2156-2159. 8 refs.

Several general physical properties of sintered SiC ceramic are listed and can readily be seen as desirable in Na/S cell fabrication. The present experimental study uses relevant criteria to evaluate the electrically conductive sintered SiC ceramic as a dual-function cathode container/electrode in a Na/S cell. The chemical inertness of sintered SiC is demonstrated in anhydrous melts (350 C) of sulfur, and a range of sodium polysulfides (primarily Na₂S₄) under a variety of experimental conditions; these include the application of anodic and cathodic currents for extended time periods, melt exposure with no applied potentials, and conditions of actual Na/S cell cycling. In addition, the ability to cycle such cells in the two-phase region is demonstrated. The electrical and mechanical properties as well as the formability of this material are shown to be adequate for use in first-generation prototype Na/S cells. In conclusion, sintered SiC can successfully be used as a noncorrodable structural material in Na/S cells. It may be used as an electrically conducting or nonelectrically conducting cell component in contact with catholyte and/or oxidizing atmosphere. S.D.

A80-14592 # Thermodynamic analysis of thermomechanical solar energy converters operating in conjunction with solar cells (Termodinamicheskii analiz teplosilovyykh preobrazovatelei solnechnoi energii rabotaiushchikh v bloke s FEP). B. A. Bazarov and B. D. Tairov (Akademiia Nauk Turkmenkoï SSR, Fiziko-Tekhnicheskii Institut, Ashkhabad, Turkmen SSR). *Geliotekhnika*, no. 4, 1979, p. 10-13. In Russian.

The paper examines the operation of a solar energy system combining solar cells and a thermomechanical converter based on a Freon turbine with power output up to 10 kW. The basic thermodynamic and design parameters of such a system are investigated and compared to that of other Freon and water-vapor systems. B.J.

A80-14593 # High-voltage multijunction solar cell (Vysokovol'tnyi mnogoperekhodnyi fotoelektricheskii preobrazovatel' solnechnoi energii). V. G. Doroshenko, M. B. Zaks, V. A. Kalash'ian, V. N. Lozovskii, Iu. V. Skokov, and O. I. Solodukha. *Geliotekhnika*, no. 4, 1979, p. 14-18. In Russian.

The paper examines the photoelectric properties of single-crystal silicon high-voltage solar cells with bulk arrangement of p-n junctions, obtained through gradient zone recrystallization. The temperature dependence of the basic properties of such cells was studied in the 100-400-K range, and volt-ampere characteristics at high illumination intensities were examined. B.J.

A80-14594 # Maximum cold-generation capacity of thermoelectric refrigerators (Maksimal'naia kholodoproizvoditel'nost' termoelektricheskikh okhlazhdaushchikh ustroystv). R. V. Koval'skii (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR). *Geliotekhnika*, no. 4, 1979, p. 19-24. 6 refs. In Russian.

The paper investigates conditions under which a thermoelectric refrigerator with constant working-fluid temperature and a specified

cold-generation capacity has minimum size, weight, and amount of thermoelectric material. The effect of switching losses on device optimization is considered, and an analytical relationship for determining optimal branch height of thermoelectric elements is proposed. B.J.

A80-14595 # Evaluation of conductor mass and necessary voltage level for large satellite solar arrays (Otsenka massy tokoprovodov i neobkhodimogo urovnia napriazheniia krupnykh orbital'nykh solnechnykh batarei). A. Kh. Cherkasskii (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istochnikov Toka, Moscow, USSR). *Geliotekhnika*, no. 4, 1979, p. 25-29. In Russian.

Estimates are obtained in a dimensionless form for the necessary mass of conductors for a large satellite solar array. In addition, necessary voltage levels at array output terminals are estimated as a function of area. B.J.

A80-14596 # Development of optical waveguides for a power-related application (Razrabotka i primeneniye silovykh svetovodov). V. S. Dverniakov, V. V. Pasichnyi, I. E. Kasich-Pilipenko, T. V. Eremina, D. K. Sattarov, M. I. Murav'eva, and I. E. Galant (Akademiia Nauk Ukrainskoi SSR, Institut Problem Materialovedeniia, Kiev, Ukrainian SSR). *Geliotekhnika*, no. 4, 1979, p. 36-39. 6 refs. In Russian.

The paper examines the possibility of using optical waveguides to transmit high-flux solar radiation in solar-furnace type systems. The waveguides will be used to deliver concentrated solar radiation for such manufacturing processes as zone melting, welding, and heat treatment. Design parameters and materials selection for such waveguides are considered. B.J.

A80-14597 # Selective ray-absorption as means of increasing the efficiency of a high-temperature solar energy system (Selektivnoe luchepogloshchenie kak sredstvo povysheniia effektivnosti vysokotemperaturnoi gelioenergeticheskoi ustanovki). O. I. Kudrin, A. Abdurakhmanov, and I. A. Aggeeva. *Geliotekhnika*, no. 4, 1979, p. 40-48. In Russian.

The use of selectively absorbing surfaces to increase the efficiency of high-temperature solar energy systems is examined. Particular attention is given to the application of selective absorption to: (1) a high-temperature Stirling-engine system and (2) a solar thermal rocket engine. B.J.

A80-14655 Studies in heat transfer: A Festschrift for E. R. G. Eckert. Edited by J. P. Hartnett (Illinois, University, Chicago, Ill.), T. F. Irvine, Jr. (New York, State University, Stony Brook, N.Y.), E. Pfender (Minnesota, University, Minneapolis, Minn.), and E. M. Sparrow (Minnesota, University, Minneapolis, Minn.). Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979. 528 p. \$42.50.

The book is a state-of-the-art overview of modern heat transfer, which details the most important new research, techniques, and procedures in the field. Significant topics such as boundary layers, external flows and jets, natural convection, internal flows, solar energy, conduction and fins, and boiling and condensation are covered. New information is presented on turbine blade cooling in aeroengines, heat transfer in axisymmetric confined jets, and natural convection in salt solutions near melting ice surfaces. Also covered are evaluations of solar collectors and energy converters, absorption heat pumps for solar space heating systems, the thermal conductivity of Apollo 15 lunar soil, and other subjects of interest. S.D.

A80-14667 Heat transfer to a melting solid with application to thermal energy storage systems. R. J. Goldstein and J. W. Ramsey (Minnesota, University, Minneapolis, Minn.). In: *Studies in heat transfer: A Festschrift for E. R. G. Eckert*. Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979, p. 199-208. 5 refs. NSF Grant No. ENG-77-21626.

The shape of a liquid-solid interface and the local heat transfer rate at this interface are studied. The experiments are performed

with naphthalene in an apparatus that is designed to permit continuous observation of the melting process. In addition, the heater contains thermocouples to evaluate the time-varying heater wall temperatures and heat transfer coefficients. Photographs of the molten region are used to evaluate the local progression of the solid-liquid interface and thus the local heat transfer rates at the interface. It is noted that for a considerable period of time the total volume of the melted region can be closely obtained from the total heat flow and the density and latent heat of the solid. The actual shape of the molten region can vary considerably depending on the conditions as a plume begins to develop. V.T.

A80-14670 Solar collectors as energy converters. F. Bosnjakovic (Stuttgart, Universität, Stuttgart, West Germany). In: *Studies in heat transfer: A Festschrift for E. R. G. Eckert*. Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979, p. 331-381. 8 refs. Translation.

A thermal solar collector operates with the energy of solar radiation, which is available partly as direct, terrestrial primary radiation and partly as indirect, diffuse secondary radiation, which is scattered by the atmosphere in all directions. The solar disk, as a first approximation, acts as a blackbody with an effective temperature of 5780 K. It is shown that the thermodynamic utilization of solar energy in currently available thermal collectors can be described as unsatisfactory to good. Apart from the influence of the weather, the efficiency depends primarily on the choice of the collector and on its operation. The ultimate yield of solar energy depends, however, not only on the collector, but also on the thermodynamic efficiency of the required supplementary equipment attached to the collector, such as simple heat exchangers, heat pumps or heat-generating power plants. The development of first-rate collectors and comparable supplementary equipment is suggested to be important for the prospects of future success in the utilization of solar energy. S.D.

A80-14671 Influence of the working fluid on heat transfer and layout of solar tower receivers. K. Bammert (Hannover, Technische Universität, Hannover, West Germany). In: *Studies in heat transfer: A Festschrift for E. R. G. Eckert*. Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979, p. 383-400. 13 refs.

Heat transfer to working medium is studied for a cylindrical or polygonal receiver with inner tubes. A method for calculating the distribution of the absorbed heat flux intensity on the tube surface is presented assuming axisymmetric irradiation in the receiver and considering both the tube cage geometry and reflection from the inner wall of the receiver. The method is applied to the layout of receivers in solar tower plants with closed-cycle gas turbines. A helium plant and an air plant with an output at terminals of 20 MW are taken into consideration. For both receivers an optimum irradiation pattern as well as the most favorable values for the receiver inlet pressure and geometric dimensions are given. V.T.

A80-14672 Absorption heat pumps for solar space heating systems. K. F. Knoche and D. Stehmeier (Aachen, Rheinisch-Westfälische Technische Hochschule, Aachen, West Germany). In: *Studies in heat transfer: A Festschrift for E. R. G. Eckert*. Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979, p. 401-408.

The use of an absorption heat pump to reduce solar collector operating temperatures to below the ambient temperature and thereby increase the efficiency of solar space heating is discussed. The operational principles and enthalpy-composition diagram of a single-stage absorption device are illustrated for a lithium bromide-water absorber system, and results of a parameter survey which indicate the greater desirability of a flexible ratio between heat recovered and the heat necessary to drive the absorption boiler are presented. A multi-stage absorption device, which would allow such a variable heat ratio to be realized in an absorber-resorber system, is outlined, and the similarity of the dependence of its heat ratio on collector entrance temperature to that of a reversible process is pointed out. A.L.W.

A80-14675 **The thermal triode.** P. Grassmann and W. Doerfler (Institut für Verfahrens- und Kältetechnik Zurich, Switzerland). In: *Studies in heat transfer: A Festschrift for E. R. G. Eckert.* Washington, Hemisphere Publishing Corp.; New York, McGraw-Hill Book Co., 1979, p. 475-484. 8 refs.

A hot water or steam heating system is a rectifier, for heat is transported only if the heat source is below the heat sink; this principle therefore applies to heat pipes. The paper demonstrates that it is possible to construct a thermal triode by adding a controlling zone to a heat pipe. This approach corresponds to the well-known electronic triode (three-electrode valve containing anode, cathode, and control grid electrode). The heat flow through the tube corresponds to the electron current and the temperature of the controlling zone corresponds to the biasing potential of the grid. The theory of such a thermal triode is developed and proved by experiment. S.D.

A80-14685 * **Solar cell spectral response characterization.** E. F. Zalewski and J. Geist (National Bureau of Standards, Radiometric Physics Div., Washington, D.C.). *Applied Optics*, vol. 18, Dec. 1, 1979, p. 3942-3947. 15 refs. NASA-supported research.

The absolute spectral response of solar cells is reported in the 400-1000-nm spectral region. Measurements were performed using two different types of monochromatic sources: amplitude-stabilized CW laser lines and interference filters with an incandescent lamp. Both types of calibration procedures use electrical substitution radiometry as the basis of traceability to absolute SI units. The accuracy of the calibration is shown to be limited by the nonideal characteristics of the solar cells themselves, specifically spatial nonuniformities and nonlinearities induced by high light levels.

(Author)

A80-14700 * # **The role of technology as air transportation faces the fuel situation.** C. Driver (NASA, Langley Research Center, Hampton, Va.). *Upper Midwest Council, Meeting, Minneapolis, Minn., Nov. 1, 1979, Paper.* 14 p. 17 refs.

The discussion of system integrators whose task is to identify the application and payoff of various research disciplines is limited to aircraft of the subsonic commercial transport type. The aim is to provide a brief description of the existing fuel situation, the progress made in fuel reduction, near-term prospects for further reductions, and long-term prospects for even further reductions, all primarily from the technology point of view. V.P.

A80-14701 **Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings.** Workshop sponsored by the American Institute of Aeronautics and Astronautics. Edited by L. B. Sidor. Los Angeles, American Institute of Aeronautics and Astronautics, Inc. (AIAA Monograph Series, Volume 25); North Hollywood, Calif., Western Periodicals Co., 1979. 230 p. \$42.

The proceedings consider the role of technical societies in technology transfer. Attention is also given to the political realities of technology transfer. Discussion of transportation command and control covers topics such as: the BEEP demonstration project, new technology and vehicle operation on roadways, and hydrogen fuel applications for urban transit. Environmental modelling and monitoring covers topics such as the application of the ATMOSAT system to air pollution monitoring, and advances in heavy gas dispersion modelling. Areas also covered are energy demonstration projects, air pollution abatement, and planning and management techniques. M.E.P.

A80-14702 * # **New technology and vehicle operation on roadways.** D. W. Humphreys (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: *Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings.* Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 35-44. 14 refs. Research sponsored by the U.S. Department of Energy and U.S. Department of Transportation.

Some concepts towards the optimum movement of vehicles on highways are presented. It is stressed that in proper perspective, the private automobile is one element of several modes of transportation. The modal mix in the long run is determined by proper land use planning, population density, and historic growth patterns. Discussion investigates the two main interacting elements of the highway in the dynamic state: the roadway and the driver operated vehicle, noting that the inefficiencies of the system are caused by the uncoordinated and disassociated actions of the two elements. Also discussed are vehicle operations on streets, highways, and freeways, on board communication, control, and guidance, systems considerations and traffic management, and benefits of optimized vehicle operations on roadways. M.E.P.

A80-14703 # **Hydrogen fuel applications for urban transit.** C. A. MacCarley (Denver, University, Denver, Colo.). In: *Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings.* Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 45-62. 24 refs.

It is noted that hydrogen represents a fuel that is independent of oil supplies and virtually non-polluting. Also NASA and the aerospace industry have contributed to an increased understanding of the fuel properties of hydrogen, and its increased range of applications. It is reported that technology now exists for the conversion of city buses, trucks and rail systems to hydrogen fuel. The paper discusses the technical aspects of hydrogen vehicle systems, and summarizes past and present working examples. Finally, an integrated refuse disposal-hydrogen fueled transit system for Denver, Colorado is proposed. M.E.P.

A80-14706 * # **Heat and electricity from the sun using parabolic dish collector systems.** V. C. Truscillo and A. N. Williams (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: *Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings.*

Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 137-149. 5 refs. Research sponsored by the U.S. Department of Energy.

The paper investigates point focus distributed receiver (PFDR) solar thermal technology for the production of electric power and of industrial process heat. Attention is given to a thermal systems project conducted by JPL under DOE sponsorship. It is reported that project emphasis is on the development of cost-effective systems which will accelerate the commercialization and industrialization of plants up to 10 MWe, using parabolic dish collectors. Also discussed are the characteristics of PFDR systems, the cost targets for major systems hardware, and markets for this technology. Finally, the present system status of the technology development effort is discussed. M.E.P.

A80-14707 # **Application of solar and fuel cell technology to industrial users.** G. H. Gelb (TRW Energy Systems Group, Redondo Beach, Calif.). In: *Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings.* Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 162-178.

The paper presents the results of two studies on the application of developing near term energy technologies of actual industrial applications. The first study applies solar energy collection to the production of medium temperature steam for a food processor. The second addresses the feasibility of using phosphoric acid fuel cells for the production of aluminum. Finally, design methodology and technical constraints are identified and the institutional and economic realities in each application are discussed. M.E.P.

A80-14708 # **Vehicle emissions control and its effect on engine development.** N. Kayne (California Air Resources Board, El Monte, Calif.). In: *Society and Aerospace Technology Workshop,*

Los Angeles, Calif., November 15, 1979, Proceedings.

Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 185-187.

It is noted that as emissions standards have become more stringent over the years, equipment for controlling engine parameters has become complex and the parts highly interdependent. The paper presents a brief overview of electronic equipment as well as computers which are being employed to sense and control various engine parameters. The conflict between reduced emissions and reduced fuel consumption is also considered. Attention is given to the three way catalyst system noting the need for electronics to effectively implement such a system. Also discussed are physical changes such as weight and size reductions in motor vehicles and the need for accurate diagnosis and maintenance to keep such systems functioning properly.

M.E.P.

A80-14709 # Hydrogen - The Denver story. E. K. Demos (Denver City and County, Dept. of Public Works, Denver, Colo.). In: Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings. Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 191-196.

The paper describes a solid waste to steam to hydrogen project being considered for implementation by the City and County of Denver, Colorado. Attention is given to issues leading to the decision to consider such a project, along with financial, institutional, and environmental concerns. Topics discussed include solid waste management, steam energy, air pollution control, energy shortages, chain of events/project status, hydrogen safety and financial considerations. It is concluded that while many questions remain unanswered, especially financial, the city's willingness to offer long term waste tonnage commitments to the project, and a strong commitment by the PSCo to purchase steam are important points in favor of the project.

M.E.P.

A80-14791 Earth benefits of solar power satellites. P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). In: Space - The best is yet to come; Proceedings of the Sixteenth Space Congress, Cocoa Beach, Fla., April 25-27, 1979. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1979, p. 5-11 to 5-25. 25 refs.

The paper presents the potential of solar energy for global needs with emphasis on solar energy conversion in space for use on earth. This approach is compared with terrestrial solar energy conversion methods, and the concept of the solar power satellite (SPS) is presented. The technology options for converting solar energy in space, transmitting power, and converting it on earth into electricity are summarized, and the requirements for space transportation systems, orbital assembly, and maintenance are reviewed. The economic, institutional, and environmental aspects of SPS operations are discussed; a phased SPS development program and possible organizational structures to produce power generation on earth are outlined.

A.T.

A80-14794 A link between science and applications of automatic control; Proceedings of the Seventh Triennial World Congress, Helsinki, Finland, June 12-16, 1978. Volumes 1, 2, 3 & 4. Congress sponsored by the International Federation of Automatic Control and Ministry of Education of Finland. Edited by A. Niemi (Helsinki University of Technology, Esbo, Finland). Oxford and New York, Pergamon Press, 1979. Vol. 1, 839 p.; vol. 2, 837 p.; vol. 3, 742 p.; vol. 4, 367 p. Price of four volumes, \$400.

The Congress focused on electric power system dynamics, thermal power plant control, nuclear power plant dynamics and control, thermal processes in metallurgical industries, computer control of paper plants, chemical process control, heating systems, modelling of physiological systems, clinical health care control, systems engineering, management systems, mathematical programming, applications in control, guidance and control of aircraft, spacecraft navigation and guidance, transportation systems, and environmental and urban systems. Papers were presented on oil yield

from oil shale retorting, parameter estimation of radiocardiograms with minicomputers, integrated walking robot modelling and simulation, energy management and singular perturbations in flight mechanics, attitude and orbit control requirements on application satellites and their ground stations, a combined system of vehicle motion control, command and stability systems for aircraft, and optimal orbital transfer strategy for geostationary satellites.

A.T.

A80-14795 Optimal oil yield from in situ oil shale retorting. A. Ahmad (Owens-Corning Fiberglass Technical Center, Granville, Ohio), J. H. George, and H. G. Harris (Wyoming University, Laramie, Wyo.). In: A link between science and applications of automatic control; Proceedings of the Seventh Triennial World Congress, Helsinki, Finland, June 12-16, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 287-290. 15 refs. Contract No. E(49-18)-2234.

Recent oil price increases have made oil shale hydrocarbon reserves much more attractive for development. Utilization of oil shale involves retorting to produce oil, which requires either mining and above ground processing, or treatment by an in situ method. Because of the high costs and environmental problems associated with mining, above ground processing, and disposing of spent shale, the in situ approach is being investigated in detail, and appears to be a viable alternative. A control scheme is proposed which optimizes the oil yield based on a model developed to describe operation of the Laramie Energy Research Center 150 ton oil shale retort at Laramie, Wyoming; this retort was designed and operated to simulate in situ processing of oil shale. It is possible to obtain increases in oil yield by the optimization program.

(Author)

A80-14837 On the basic dynamics of extracting power from waves. P. C. Parks (Royal Military College of Science, Shrivenham, Wilts., England). In: A link between science and applications of automatic control; Proceedings of the Seventh Triennial World Congress, Helsinki, Finland, June 12-16, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 1537-1542. 5 refs.

The paper examines some basic mechanisms for extracting power from waves, first from waves on taut strings and then from waves in the sea. A mathematically attractive device for absorbing power from sea waves is proposed in the form of an exponentially shaped wedge containing a tuned mass-spring system with damping. Attention is given to single and double-sided systems; singled-sided systems suitably tuned were found to extract all the power from an incoming harmonic wave train, while the double-sided systems can usually extract only half this power.

C.F.W.

A80-14844 An optimization model for overall urban energy planning. C. Mattsson and J. A. Bubenko (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: A link between science and applications of automatic control; Proceedings of the Seventh Triennial World Congress, Helsinki, Finland, June 12-16, 1978. Volume 3. Oxford and New York, Pergamon Press, 1979, p. 1657-1659. Research supported by the Statens Rad for Byggnadsforskning.

A model is presented for overall energy planning of an urban region with respect to the preference of energy forms. The region is divided into subareas depending on land use and their locations. Electrical and heating demands are forecasted for each subarea and network capacities and linearized cost functions. The objective is to find appropriate energy forms in each subarea to minimize the annual costs. This approach will be used to analyze the economical aspects of different trends in energy consumption, land use potentials and system performance. Finally, the model can be used to analyze the consequences of the uncertainties in cost parameters and demand forecasting.

(Author)

A80-14948 Enhanced power generation of GSS/4/PS by optical solar reflectors. P. R. K. Chetty and R. M. Vasagam (Indian Space Research Organization, Satellite Centre, Bangalore, India). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-15, Sept. 1979, p. 690-695. 8 refs.

A novel arrangement is proposed to enhance the power generation capabilities of a gravitationally stabilized solid-state-satellite solar-power station (GSS(4)PS) spherical solar collector. The unilluminated portion of a GSS(4)PS is illuminated by employing optical solar reflectors. The different mechanisms required for implementation of this arrangement are already space proven. The detailed study of this arrangement made by the authors reveals that practical realization of this concept will enhance the power generation capability of the GSS(4)PS and simultaneously reduce the weight per unit power and cost per unit power in GSS(4)PS spherical solar collectors. (Author)

A80-14960 **CO₂ electric discharge lasers - Present status and future applications.** J. P. Reilly (W. J. Schafer Associates, Inc., Wakefield, Mass.). In: Gas-flow and chemical lasers; Proceedings of the Second International Symposium, Rhode-Saint-Genèse, Belgium, September 1978. Washington, D.C., Hemisphere Publishing Corp., 1979, p. 129-149. 13 refs.

CO₂ electric discharge lasers (EDLs) have proven themselves to be efficient sources of high-power high-quality laser energy. The paper outlines applications of high-power CO₂ EDLs, applications which are now becoming commercially viable, as well as those which are still being investigated in research laboratories. Applications of CO₂ lasers are discussed relative to industrial applications (laser welding, laser surface hardening, heat treatment, and surface chemistry modification by laser alloying and laser glazing), laser radar applications, laser-induced fusion, and laser propulsion. Attention is given to requirements of applications versus status of technology. Examples are given of the engineering solutions used to address the technology issues identified by particular laser applications. S.D.

A80-15136 **Efficient indium tin oxide/polycrystalline silicon solar cells.** J. P. Schunck (CNRS, Centre de Recherches Nucléaires de Strasbourg, Strasbourg, France) and A. Coche (Strasbourg I, Université, Strasbourg, France). *Applied Physics Letters*, vol. 35, Dec. 1, 1979, p. 863-865. 24 refs.

ITO/Si-N solar cells have been fabricated by a spraying process at 500 C on polycrystalline silicon. Electroless nickel plating was used for the back Ohmic contact deposition. Electrical characteristics and spectra response of these heterojunctions are compared to those obtained on monocrystalline silicon. AM1 efficiency of approximately 9 percent (based on active area) is achieved for polycrystalline material. Temperature dependence of open-circuit voltages and short-circuit currents are comparable to those reported for diffused Si junctions and Si-based MIS cells. (Author)

A80-15141 **Calculated and measured efficiencies of thin-film shallow-homojunction GaAs solar cells on Ge substrates.** J. C. C. Fan, C. O. Bozler, and B. J. Palm (MIT, Lexington, Mass.). *Applied Physics Letters*, vol. 35, Dec. 1, 1979, p. 875-878. 13 refs. USAF-sponsored research.

By using a simple analytical model for GaAs solar cells with the $n(+)/p(+)$ shallow-homojunction structure, good fits have been obtained between computer calculations and experimental data for the external quantum efficiency and AM1 conversion efficiency of thin-film GaAs cells with different values of $n(+)$ layer thickness grown on Ge substrates. The calculations yield values for material properties of the GaAs layers composing the cells and also permit the optimization of cell design parameters. In addition, the agreement between calculation and experiment demonstrates that the Ge substrates play a passive role. Thus there has been success in fabricating 21 % efficient thin-film GaAs solar cells on non-GaAs substrates. (Author)

A80-15175 **The promise and puzzle of electric vehicles.** M. Wayne (Electric Power Research Institute, Palo Alto, Calif.). *EPRI Journal*, vol. 4, Nov. 1979, p. 6-15.

Electric vehicles (EVs) promise energy and environmental benefits which could cut U.S. oil use as well as hydrocarbon and CO

emissions in half if they replaced the private passenger car. The drawbacks of their batteries are limited range (20-40 miles), top speed of 40-55 mph, long recharging time, and a 25-40% premium in cost over a similar gasoline-powered car. Should a breakthrough in battery technology occur (being tested are lead-acid, nickel-iron, nickel-zinc, zinc-chlorine, sodium-sulfur, and lithium-iron sulfide types), EVs would run more cheaply on electricity than on gasoline or synthetic fuels, and have fewer engine parts to wear down than conventional cars. However, these batteries are hampered by low energy density, short cycle life, high cost, or high operating temperature. Other EV commercialization possibilities include electrified highways, a massive network of public recharging outlets, battery exchange, or a greater emphasis on hybrid (electric and gasoline) vehicles. J.P.B.

A80-15267 * # **Cooling a radioisotope power source in the Space Shuttle Orbiter.** D. I. Levine (Rockwell International Corp., Downey, Calif.) and L. D. Stimpson (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, 9th, San Francisco, Calif., July 16-19, 1979, Paper 79-ENAS-44*. 7 p. Members, \$1.50; nonmembers, \$3.00.

Radioisotope thermoelectric generators (RTG's), used to generate electrical power on outer planetary spacecraft, are presently planned for a January 1982 launch of Galileo and later for a February 1983 launch. The RTG's will be externally located on a spacecraft to be deployed from the Space Shuttle Orbiter. Each RTG rejects nearly 2.5 kW (8500 Btu/hr) of thermal energy. From the time the RTG's are loaded into the payload bay until the doors are opened one to three hours after launch, active cooling will maintain proper temperature limits. This paper includes a description of two types of RTG's and the various cooling concepts considered. The payload cooling capability of the Shuttle Orbiter and modifications required to accommodate the RTG's are discussed. The analytical technique for determining the heat load split between the orbiter environment and RTG coolant is also presented. (Author)

A80-15328 **Calculation of steam generation with parabolic solar collectors (Berechnung der Dampferzeugung mit parabolischen Sonnenkollektoren).** M. Kuczera (Dornier System GmbH, Friedrichshafen, West Germany) and R. Günther. *Brennstoff-Wärme-Kraft*, vol. 31, Nov. 1979, p. 432-436. In German.

The paper presents a mathematical model which can be used to calculate the energy flow, temperatures, and efficiency degree of the steam generation performed by a cylinder-parabolic solar collector with a shielding pipe. Attention is given to a collector without a shielding pipe, a collector with a transparent shield pipe, and gray and selective absorbers. Finally, the results are compared with those from the literature. It is shown that there is no loss in operating efficiency if the steam is super heated to 500 C or 550 C. The system operated at 30 bar pressure and it is concluded that this pressure can be raised to that typical of power generating plants without any fundamental difficulties. M.E.P.

A80-15329 **Measurements on a 15 kW wind energy conversion system (Messungen an einer 15 kW-Windkraftanlage).** U. Machens (Giessen, Fachhochschule, Giessen, West Germany). *Brennstoff-Wärme-Kraft*, vol. 31, Nov. 1979, p. 437-440. In German. Research supported by the Bundesministerium für Forschung und Technologie and Bundesministerium für wirtschaftliche Zusammenarbeit.

The paper describes a WECS which generates with an asynchronous alternator and supplies electricity to the power grid under adequate wind conditions. Attention is given to the design which consists of a high three bladed device with a horizontal axis which is 15 m i. diameter. Also discussed are the measurement facilities. Finally, the results after 300 hours of operation are examined. M.E.P.

A80-15330 **The Kirsten rotor as a wind turbine (Der Kirstenrotor als Windrad).** W. M. Pieper (Giessen, Fachhochschule, Giessen, West Germany). *Brennstoff-Wärme-Kraft*, vol. 31, Nov. 1979, p. 441-445. 18 refs. In German.

The paper calculates the output of a Kirsten rotor in terms of the various relationships between peripheral speed and wind speed and for various blade widths. Attention is given to the kinematics and dynamics of the Kirsten rotor. An equation is derived for the numerical evaluation of the rotor output. Finally, a demonstration model tested in a water tunnel is mentioned and comparisons are made with the Darrieus rotor. M.E.P.

A80-15358 Coulombic effects in the quenching of photo-excited Tris(2,2'-bipyridine)ruthenium(II) and related complexes by methyl viologen. G. L. Gaines, Jr. (General Electric Co., Schenectady, N.Y.). *Journal of Physical Chemistry*, vol. 83, Nov. 29, 1979, p. 3088-3091. 24 refs. Contract No. EG-77-C-02-4395.

A study of the quenching of luminescence of several ruthenium(II)-bipyridyl complexes by methyl viologen in aqueous salt solutions using intensity and lifetime measurements is presented. One neutral complex shows no salt effect and its quenching rate constant is near the diffusion-controlled limit; another neutral complex exhibits a small negative salt effect, possibly due to its highly dipolar structure. The three positively charged complexes studied are all quenched with similar rate constants and show similar large positive salt effects; the quenching rate constant increases sixfold when neutral salt (NaCl) is increased from 0.03 to 1.5 M, and at the highest salt content it is within a factor of 2 of the diffusion-controlled limit. While the results are consistent with the conventional Bronsted-Debye treatment of ionic reaction rates, large specific ion effects are indicated by limited data with NaClO₄ as a neutral salt. A.T.

A80-15501 New development and applications in composites; Proceedings of the Symposium, St. Louis, Mo., October 16, 17, 1978. Symposium sponsored by the Metallurgical Society of AIME. Edited by D. Kuhlmann-Wilsdorf (Virginia, University, Charlottesville, Va.) and W. C. Harrigan, Jr. (DWA Composite Specialties, Inc., Chatsworth, Calif.). Warrendale, Pa., Metallurgical Society of AIME, 1979. 377 p. \$35.

A collection of papers is presented which directs attention to properties of composites with components of ultrasmall dimensions, and to new applications of composites in all important areas, not only for structures but also for superconducting devices, electric contacts, and magnets. The book spans both the whole range of the most important physical (as contrasted to chemical) aspects of composites and the range from basic research to the latest industrial uses and future planning. Methods that can be employed in the production of composites with tailor-made structures are also considered. S.D.

A80-15511 Superconducting composites fabrication and properties. E. Gregory (Aircor Central Research Laboratories, Murray Hill, N.J.). In: New developments and applications in composites; Proceedings of the Symposium, St. Louis, Mo., October 16, 17, 1978. Warrendale, Pa., Metallurgical Society of AIME, 1979, p. 175-196. 90 refs.

The paper describes the present commercial fabrication methods and the properties of the two most generally available multifilamentary composite conductors in the U.S.A., NbTi and Nb₃Sn. An attempt is made to explain the reasons why commercial superconductors should have composite structures. Some possible future manufacturing techniques are mentioned. The complex factors affecting the optimization of the electrical and mechanical properties of the Nb₃Sn composites are discussed in some detail. S.D.

A80-15512 Preparation of superconducting coil through composite. F. E. Wang and A. P. Divecha (U.S. Navy, Naval Surface Weapons Center, Silver Spring, Md.). In: New developments and applications in composites; Proceedings of the Symposium, St. Louis, Mo., October 16, 17, 1978. Warrendale, Pa., Metallurgical Society of AIME, 1979, p. 197-203. 9 refs.

The usefulness and application of a superconductor are critically dependent on its critical temperature and on how much current it

can carry at how high a field. Nb₃Al is potentially very attractive as a practical superconductor because it has the highest critical temperature (in bulk) and critical field. The problem of instability can be alleviated in four ways: utilize a superconductor with sufficiently high critical temperature, bleed off the heat generated, retard the motion of magnetic flux, and make the superconductor so finely divided that heat pulse cannot be generated to get the instability going in the first place. Taking these possible solutions into account, a multistep technique is proposed for forming a superconducting composite coil based on Nb₃Al. The inherent advantages of this technique are summarized. The technique includes all the possible solutions in one sweep to remedy the instability encountered in the application of superconductivity to motor and generator devices. S.D.

A80-15532 Volt-second consumption during the start-up phase of PLT. R. J. Hawryluk, K. Bol, and D. Johnson (Princeton University, Princeton, N.J.). *Nuclear Fusion*, vol. 19, Nov. 1979, p. 1519-1522. 13 refs. Contract No. EY-76-C-02-3073.

The volt-second consumption in the PLT tokamak was measured. During the start-up phase, the volt-second consumption is determined primarily by the external and internal flux required to establish the current profile. The resistive volt-second loss on axis is typically less than 1/4 of the total volt-seconds consumed during the first 180 ms of the discharge. The measurements reported here provide an empirical basis for establishing the volt-second requirements for future tokamak devices. (Author)

A80-15625 The role of coal in the world energy picture up to the year 2000 - Reserves, resources, and availability from the Western European viewpoint (Die Rolle der Kohle im Weltenergiebild bis zum Jahre 2000 - Reserven, Ressourcen und Verfügbarkeit aus westeuropäischer Sicht). R. Neumann (Kernforschungsanlage Jülich GmbH, Jülich, West Germany). *Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoff-Chemie*, vol. 32, Nov. 1979, p. 505-512. 27 refs. In German.

The paper stresses the importance of the situation of reserves of the fossil primary energy sources in determining the role of coal in the world energy picture. An analysis of the volume of the reserves is presented that leads to higher estimation of crude oil and natural gas reserves than is usual today. It is suggested that the established coal reserves are not clearly defined and thus cannot be directly compared with oil and gas reserves. Also, it is not likely that these reserves will be exhausted by 2000. It is noted however, that actual availability must be judged differently. It is hypothesized that problems with environmental protection, the necessity of transferring coal production into less accessible areas, and of transport problems will not allow a production significantly higher than 5 x 10 to the 9 tce in the year 2000. Finally, consideration is given to the possibility that the main coal producing countries in the world - USA, USSR, and China, will themselves need the coal they produce in a situation of energy scarcity. M.E.P.

A80-15653 # A study of the thermal effect that radiant energy produces on a mass of water (Estudio del efecto térmico que la energía radiante produce sobre una masa de agua). M. I. S. Lopez. Extremadura, Universidad, Facultad de Ciencias, Grado de Licenciado Thesis, 1978. 77 p. 31 refs. In Spanish.

A study of heat transmission via conduction in water irradiated by a 250 W infrared lamp is reported. A plexiglass cube containing 39,304 cc of isotropic, homogeneous, distilled water (electrical conductivity of four millionths/ohm) was used, and the temperature of the experiment did not exceed 40 C so as to eliminate any effects due to convection. The water is assumed to be continuous, and the heat dynamics are considered differentially. Applying Fourier's law of the conductivity of solids, one can calculate to a very good approximation the temperature at any point and at any moment in a mass of irradiated water. J.P.B.

A80-15658 **Electric and hybrid vehicles.** Edited by M. J. Collie. Park Ridge, N.J., Noyes Data Corp. (Energy Technology Review, No. 44), 1979. 652 p. \$36.

The report presents data developed by the ERDA with the assistance of NASA on the state of the art of electric and hybrid vehicles. Attention is given to three sources of data: (1) controlled tests of a representative sample of commercially available and experimental electric and hybrid vehicles, (2) information and data from the literature and vehicle manufacturers, and (3) the experience of users, both fleet operators and individual owners. Topics covered include electric vehicles - theoretical background, vehicle components such as tires, traction motors, controllers, batteries, and battery chargers, as well as hybrid vehicles, and electrochemical devices. Discussion of foreign technology covers foreign all-electric and hybrid-electric vehicle R&D, power sources, drive systems, and control systems for electric vehicles, military electric vehicles, computer analysis of foreign traction batteries in all-electric vehicles. Finally, the latest developments available Jan. 1979 are reviewed including R&D and updated assessment. M.E.P.

A80-15659 **Heat exchange fluids and techniques.** M. W. Ranney. Park Ridge, N.J., Noyes Data Corp. (Energy Technology Review, No. 50; Chemical Technology Review, No. 143), 1979. 402 p. \$42.

The book presents detailed technical information based on United States patents issued since January, 1975 on heat exchange fluids and techniques, emphasizing the potential energy savings attainable. Attention is given to general heat exchanger construction and design, including tubular and other constructions, particulate exchange mediums and surface treatments, and to the compositions of heat transfer fluids. Refrigerant processes and fluids are presented, together with chemical reaction, fusion and other processes for thermal energy storage and transport. Consideration is also given to the control of heat transfer processes such as air conditioning in building structures, solar and geothermal energy processes, industrial applications of heat exchange techniques in such processes as electric energy generation and plastics processing, and specialized applications in such fields as cryobiology, automotive and aircraft design and electronics. A.L.W.

A80-15705 # **Modeling and experimental analysis of a fluidic generator.** C. F. Tacey (DuPont de Nemours and Co., Engineering Dept., Wilmington, Del.), F. E. Verrier (Shell Oil Co., New Orleans, La.), L. R. Wood (Westinghouse Electric Corp., Pressurized Water Reactor Systems Div., Pittsburgh, Pa.), L. D. Mitchell, and H. A. Kursted (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *American Society of Mechanical Engineers, Design Engineering Technical Conference, St. Louis, Mo., Sept. 10-12, 1979, Paper 79-DET-9*. 11 p. 28 refs. Members, \$1.50; nonmembers, \$3.00. Army-supported research.

Modeling of the mechanical portion of a fluidic generator for its dynamic characteristics so that optimization of the power output may be attained through mechanical system modification is presented. A regression analysis is performed on experimentally obtained data to allow specific definition of defects in the model; structural inertia, stiffness, viscous damping, and internal structural damping are used to model a corrugated diaphragm, a connecting rod, coupling nuts, and a cantilever laminated rod. A computer algorithm is used to solve the impedance formulation of the model, resulting in the dynamic compliance matrix of the structural assembly. The resultant dynamic transfer compliance is compared to the experimental Fast Fourier Transform dynamic transfer compliance as measured on the actual structure. A.T.

A80-15729 # **Whirling response and stability of flexibly mounted, ring-type flywheel systems.** T. L. C. Chen and C. W. Bert (Oklahoma, University, Norman, Okla.). *American Society of Mechanical Engineers, Design Engineering Technical Conference, St. Louis, Mo., Sept. 10-12, 1979, Paper 79-DET-71*. 10 p. 21 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

An investigation of free whirling, forced whirling, and stability analyses of two ring type composite-material flywheel systems installed in a quill-shaft, air-turbine-drive test facility is presented. These systems differ from turbine/compressor systems in two respects: (1) the flywheel rim attachment to its hub is very flexible for both translation and tilting, and (2) these flexibilities depend upon rotational speed through centrifugal stiffening. It is believed that the eight-degree-of-freedom analysis presented here is the most comprehensive for such systems, and numerical results are presented for specific flywheel systems under development at Sandia Laboratories. Critical speeds encountered in the 8000 to 32,000 rpm range and a method of overcoming the adverse effect of material internal damping on the system stability by providing an adequate external damper are discussed. A.T.

A80-15750 * **A solar-heated water system for a photographic processing laboratory.** R. P. Michaelis and H. Nitta (NASA, Ames Research Center, Moffett Field, Calif.). (*Society of Photographic Scientists and Engineers and U.S. Geological Survey, Seminar on Chemical and Efficient Management, Sioux Falls, S. Dak., Oct. 1978*). *Journal of Applied Photographic Engineering*, vol. 5, Summer 1979, p. 127-131. Contract No. NAS2-9925.

A80-15968 **Colloquium on the Microclimatic Environment and Habitat, Reims, France, May 21-23, 1979, Proceedings (Colloque sur l'Environnement Microclimatique et Habitat, Reims, France, May 21-23, 1979, Proceedings).** Colloquium sponsored by the Société Française des Thermiciens and l'Académie des Sciences. Reims, Université de Reims, 1979. 244 p. In French.

Two broad topics are discussed: (1) mass and heat transfer in urban microclimates and in dwellings; and (2) adaptation of dwellings to the microclimate. Particular consideration is given to: humidity transfer in walls; microclimate structure and heat flux measurements; solar adaptation of dwellings; climatic adaptation of dwellings by latent heat of fusion; and humidity control in buildings. B.J.

A80-15976 **Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation, 1st, Brussels, Belgium, October 3, 4, 1978, Proceedings.** Seminar sponsored by the Commission of the European Communities. Luxembourg, Commission of the European Communities, 1978. 593 p. In English, French, German, and Italian.

The seminar focused on the thermochemical production of hydrogen, hydrogen production by water electrolysis, basic and future technologies, hydrogen use, storage, and transportation. Papers are presented on pulsed electrocatalytic dissociation of water vapor, liquid-gas equilibrium in the bromine-hydrobromic acid-water system, hybrid process for hydrogen generation, hydrogen production by hybrid thermoelectric cycles, alkaline inorganic-membrane-electrolyte water electrolysis, application of electrocatalysis to the electrolysis of water at high temperature and high current density, anodic materials for the electrolysis of water, separators for electrolytic hydrogen production, fundamentals and technological aspects of medium temperature high pressure water electrolysis, hydrogen storage by reversible magnesium alloys, hydrogen storage by cryoadsorbents in comparison to alternatives, and technical-economic study of the use of hydrogen and methanol for automotive transportation. A.T.

A80-15990 **Hydrogen storage by means of reversible magnesium alloy.** P. Guinet, D. Halotier, and P. Perroud (Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaires de Grenoble, Grenoble, France). In: *Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation, 1st, Brussels, Belgium, October 3, 4, 1978, Proceedings*. Luxembourg, Commission of the European Communities, 1978, p. 373-391. 20 refs.

The hydrogen sorption-desorption characteristics of various magnesium alloys are evaluated in order to assess their hydrogen-

storage capabilities. The absorption of pure hydrogen and hydrogen containing 0.1 percent O₂ by Mg₂Cu, Mg₅Cu, Mg₂Ni, Mg₃Cd, Mg₂Sn, MgAl, Mg₂Si, Mg_{1.16}Si, Mg₁Zn, Mg₂Pd, Mg₈Al, Mg plus 1 wt percent FeTi, Mg plus 20 wt percent LaNi₅ and Mg₂Cu plus 5 wt percent FeTi alloys was determined from the pressure drop in a reaction chamber containing the metal and a specific amount of gas at temperatures up to 600 C. It is found that the sorption capacities of Mg₂Cu and Mg₂Ni degrade more slowly than those of pure Mg regardless of impurity content, and that Mg₂Ni exhibits a greater sorption capacity and desorption rate and a smaller loss of capacity with time. The hydriding kinetics and capacity of Mg₅Cu are found to be better than those of Mg, and the capacity of Mg₂Si is shown to be greater than that of Mg₂Cu, while alloys such as Mg₃Cd, Mg₂Sn, Mg₈Al and Mg₂Pd exhibited little or no sorption. Grain size and the presence of additions such as LaNi₅ are also shown to affect hydriding kinetics. A.L.W.

A80-15991 Use of reversible hydrides for hydrogen storage (Utilisation d'hydrures réversibles pour le stockage de l'hydrogène). B. Darriet, M. Pezat, and P. Hagenmüller (CNRS, Laboratoire de Chimie du Solide, Talence, Gironde, France). In: Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation, 1st, Brussels, Belgium, October 3, 4, 1978, Proceedings. Luxembourg, Commission of the European Communities, 1978, p. 392-406. In French.

The addition of a metal or alloy to form a hydride that is thermodynamically less stable than MgH₂ leads to a considerable increase in the hydriding rate of Mg. Results are presented for a study designed to assess the effect of the nature of an adjuvant alloy, its concentration, the reaction temperature, and the hydrogen pressure on the reaction rate. Results on the hydriding of Mg-rich alloys - such as Mg₂Ca, La₂Mg₁₇, and CeMg₁₂ - are presented. The hydriding mechanism of La₂Mg₁₇ and CeMg₁₂ alloys is identified. S.D.

A80-15992 Hydrogen storage by use of cryoadsorbents in comparison to alternatives. C. Carpetis and W. Peschka (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für technische Physik, Stuttgart, West Germany). In: Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation, 1st, Brussels, Belgium, October 3, 4, 1978, Proceedings. Luxembourg, Commission of the European Communities, 1978, p. 407-426. 14 refs.

The paper reports investigations on the techniques and economics of hydrogen storage by means of cryoadsorption. Also a comparison with alternative storage methods is included. The hydrogen storage capacity of several adsorbents in the temperature ranges from 65 K to 150 K has been investigated experimentally. Basing on these data economics and operating conditions for minimum total costs of the system are calculated. Utilization-factor and capacity-factor parameters are shown to be decisive for outlining the favorable ranges of application for competitive hydrogen storage methods. (Author)

A80-15993 Technico economic study of the use of hydrogen and methanol for road transport. Y. Breille, A. Chauvel, P. LePrince, C. Meyer (Institut Français du Pétrole, Rueil-Malmaison, Hauts-de-Seine, France), P. Gelin, and G. Petit (Commissariat à l'Énergie Atomique, Centre d'Études Nucléaires de Saclay, Gif-sur-Yvette, Essonne, France). In: Seminar on Hydrogen as an Energy Vector: Its Production, Use and Transportation, 1st, Brussels, Belgium, October 3, 4, 1978, Proceedings. Luxembourg, Commission of the European Communities, 1978, p. 506-530. 12 refs. European Economic Communities Contract No. 07076-EHF.

In 1977, the French Commissariat à l'Énergie Atomique and the Institut Français du Pétrole began a study of the technical and economic feasibility of using hydrogen and methanol as automotive energy sources. The paper details the portion of the study related to hydrogen distribution and summarizes the main conclusions concerning methanol. Options for the large-scale storage and transportation of gaseous and liquid hydrogen and hydrides are examined, and

different systems of energy conversion and vehicular hydrogen storage are considered. Hydrogen distribution stations are discussed, and evaluations of the economics and energetics of hydrogen use as an automotive fuel are presented. It is concluded that hydrogen internal combustion engines cannot compete with gasoline engines in the areas of primary energy consumption and fuel cost, however a hydrogen fuel cell provides appreciable energy savings at a fuel cost comparable to that of gasoline. The optimal use of methanol has been found to be as a 15 percent methanol-gasoline mixture with methanol produced in a local unit and delivered to the service station by barge and trailer. A.L.W.

A80-16083 A review of the U.S. wind energy programme. J. R. C. Armstrong, N. H. Lipman, and P. D. Dunn (Reading, University, Reading, Berks., England). *Wind Engineering*, vol. 3, no. 2, 1979, p. 75-106. Research supported by the Department of Energy of England.

A80-16084 A low level wind measurement technique for wind turbine generator siting. R. W. Baker, R. L. Whitney, and E. W. Hewson (Oregon State University, Corvallis, Ore.). *Wind Engineering*, vol. 3, no. 2, 1979, p. 107-114. 11 refs. Research sponsored by the Bonneville Power Administration.

The paper presents a low level wind measurement technique for wind turbine generator siting. The Tethered Aerodynamically Lifting Anemometer (TALA) consisting of a kite with tail, tethering line, a reel, and a scale for measurement of the line tension was tested at heights of 17 to 100 m with no systematic errors suggesting that wind drag on the line of varying lengths does not introduce a significant error. With a small lifting balloon filled with helium it can be flown in very light surface winds to a level where the wind is at least 4 m/sec, the threshold of the TALA system. Although present use of the TALA system is for a large wind turbine generator siting in a mountainous terrain, it should be equally effective for air pollution investigations. A.T.

A80-16085 Comparative performance measurements on a Savonius rotor with ancillary surfaces. D. V. Nguyen (Thiès, Ecole Polytechnique, Thiès, Senegal). *Wind Engineering*, vol. 3, no. 2, 1979, p. 115-120. 8 refs.

In an attempt to improve the performance of the conventional Savonius rotor, a model rotor was fitted with ancillary surfaces of aerofoil and 'umbrella' form to produce six alternative configurations. Wind tunnel tests on the models showed the performance to be improved in only one case; in the other units tested the drag effect of the ancillary surfaces appeared to predominate over any possible flow improvement. (Author)

A80-16086 The estimation of the parameters of the Weibull wind speed distribution for wind energy utilization purposes. M. J. M. Stevens and P. T. Smulders (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands). *Wind Engineering*, vol. 3, no. 2, 1979, p. 132-145. 16 refs. Research supported by the Dutch Ministry of Development Cooperation.

A80-16146 The methanol-air fuel cell - A selective review of methanol oxidation mechanisms at platinum electrodes in acid electrolytes. N. A. Hampson, M. J. Willars (Loughborough University of Technology, Loughborough, Leics., England), and B. D. McNicol (Shell Research, Ltd., Thornton Research Centre, Chester, England). *Journal of Power Sources*, vol. 4, Nov. 1979, p. 191-201. 85 refs. Research supported by the Science Research Council and Shell Research, Ltd.

Over the past few years there has been a resurgence of interest in methanol oxidation in acid electrolytes, where platinum group metals are the only practical catalysts. The recent literature concerning the adsorption and oxidation processes occurring at platinum in acid solutions is reviewed. The overall model based on contemporary data assumes that methanol adsorption follows Langmuir kinetics at low surface coverages and Elovich kinetics at higher values. The 'poisoning' intermediate (probably COH) is susceptible to an ageing process, rendering it less active, and its ultimate removal is

achieved via a chemical reaction with an electrosorbed water molecule. (Author)

A80-16147 Plastic bonded electrodes for nickel-cadmium accumulators. I - Cadmium electrode. J. Jindra, J. Mrha, K. Micka, Z. Zabransky (Ceskoslovenska Akademie Ved, Ustav Fyzikalni Chemie a Elektrochemie, Prague, Czechoslovakia), V. Koudelka, and J. Malik (Prazska Akumulatorka, Mlada Boleslav, Czechoslovakia). *Journal of Power Sources*, vol. 4, Nov. 1979, p. 227-237, 239-250. 20 refs.

Cadmium electrodes of outstanding electrochemical properties (over 1,000 charge-discharge cycles, active mass having a current-voltage slope of 1-2 ohm/sq. cm., volumetric capacity higher than pocket-type electrodes, depth of discharge 38 - 44% of theoretical capacity) were produced by rolling a mixture (5% polytetrafluoroethylene) of the active material onto a metallic current collector at normal temperature. Nickel oxide electrodes (68 - 74% precipitated Ni(OH)₂, 16 - 19% powdered graphite, 4 - 7% water), similarly prepared, and having a theoretical capacity of 0.214 A h/g, were tested in alkaline electrolyte. At current loads of 3 - 100 mA/sq. cm., their current carrying capability depends on the conducting component and is proportional to the area of the active layer-collector interface, which can be enlarged either by metallization of the collector or by a combination of coarse and fine metal screens, while their cycle life depends on the quality of this interface. J.P.B.

A80-16148 Methane fermentation of aquatic biomass. D. L. Wise, D. C. Augenstein (Dynatech R/D Co., Cambridge, Mass.), and J. H. Ryther (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *Resource Recovery and Conservation*, vol. 4, Nov. 1979, p. 217-237. 36 refs. Contract No. EY-76-S-02-2948.

Results of a study of the characteristics of the anaerobic fermentation to methane of four aquatic biomass species in order to evaluate their suitability as energy sources are presented. Solar-dried samples of the freshwater weeds duckweed (*Lemna* sp.) and *Hydrilla verticillata* and the marine algae *Gracilaria* sp. and *Ulva lactuca* were fermented at mesophilic conditions (37 C) in continuous stirred tank reactors using a rich nutrient feed of essentially equal parts sewage sludge and aquatic biomass; the freshwater weeds were also fermented at thermophilic (60 C) conditions. Bioconversion efficiencies of 25 to 34% and 27 to 45% were obtained at mesophilic conditions for the freshwater and marine species, respectively, and efficiencies of 32 to 46% were found for freshwater weeds at thermophilic conditions. The lower than anticipated bioconversion rates at mesophilic conditions are accounted for by the slow acclimatization of inoculating microorganisms, and bioconversion efficiencies obtained in mesophilic in situ units were found to be comparable to those obtained at thermophilic conditions in the reactors. A.L.W.

A80-16150 The uncertain costs of waste disposal and resource recovery. D. C. Wilson (U.K. Atomic Energy Authority, Harwell Laboratory, Didcot, Oxon, England). *Resource Recovery and Conservation*, vol. 4, Nov. 1979, p. 261-299. 21 refs. Research supported by the U.K. Atomic Energy Authority.

Principles of economic evaluation previously developed are applied to a case study of the available options for waste disposal or resource recovery from solid waste. The dominant feature in any such analysis at a preliminary stage of planning is the uncertainty in the cost and revenue estimates. It is shown how this uncertainty can be explicitly included, with sensitivity analysis used to isolate the critical parameters and risk analysis to examine the range of probable costs. The results of the case study suggests that, of the thirty options studied, landfill at a local site or the use of pulverized waste directly as a fuel are currently the cheapest, followed by indirect landfill or the production of a solid refuse-derived fuel. Other options, including incineration and pyrolysis, appear currently uncompetitive in economic terms. (Author)

A80-16175 Technical possibilities and economic prospects for coal refining. A. Ziegler (Ministry for Non-nuclear Energy Research and Energy Technology, West Germany) and R. Holighaus. *Endeavour*, vol. 3, no. 4, 1979, p. 150-157. 10 refs.

Methods of gasifying or liquefying coal to produce jet fuels, gas substitutes, hydrogen and electricity, are discussed. Fixed-bed gasification (Lurgi process), with gas leaving at a low temperature and coal completely converted in the high temperature zone, gives the highest overall yields; fluidized-bed gasification (Winkler gasifier) loses some coal, which is carried away in the gas stream due to short residence time and entrained gasification that has reduced yield, since coal is used to provide 1500 C heat. Coal liquefaction by hydrogenation with today's (300 bar) pressure gasification of solid residues eliminates centrifuging, while liquefaction by Fischer-Tropsch synthesis is aimed at producing high-quality chemical feedstocks and synthesizing olefins (straight or branched chains). Gasification processes in USA (maximum methane yields) and Federal Republic of Germany work in improving existing processes are detailed, as is the potential profitability of coal liquefaction.

J.P.B.

A80-16194 Non-stochastic heating of magnetized plasma by electrostatic wave. R. Sugihara and Y. Midzuno (Nagoya University, Nagoya, Japan). *Physical Society of Japan, Journal*, vol. 47, Oct. 1979, p. 1290-1295. 11 refs.

When an electrostatic wave is suddenly applied, initially trapped particles suffer a rapid, large acceleration as well as the stochastic heating, while initially untrapped particles suffer only the stochastic heating. When the bounce frequency is larger than the square root of the product of wave frequency times cyclotron frequency, the initially trapped particles mainly absorb the wave energy and form a high energy tail. The results are applied to the problem of energetic ion creation in laser fusion plasma and of a high energy tail formation in a plasma heated by the lower hybrid wave. (Author)

A80-16262 # Selected topics on surface effects in fusion devices - Neutral-beam injectors and beam-direct converters. M. Kaminsky (Argonne National Laboratory, Argonne, Ill.). In: The physics of ionized gases; Summer School, 9th and Symposium, Dubrovnik, Yugoslavia, August 28-September 2, 1978, Invited Lectures and Progress Reports. Belgrade, Institut za Fiziku, 1979, p. 717-736. 20 refs. Contract No. W-31-109-eng-38.

Neutral-beam injectors are being used for the heating and fueling of plasmas in existing devices such as PLT (Princeton), ISX (Oak Ridge) and 2XIIIB (Lawrence Livermore Laboratory) and will be used in devices such as TFTR (Princeton), MX (Livermore) and Doublet III (Gulf Atomic). For example, TFTR has been designed to receive a total of 20 MW of 120-keV deuterium atoms in pulses of 0.5-sec duration from 12 neutral beam injectors; for the MX experiment it is planned to inject a total of 750A (equivalent) of deuterium atoms with a mean energy of 56 keV in 0.5-sec pulses. The interaction of energetic deuterium atoms with exposed surfaces of device components such as beam dumps, beam-direct-converters collectors, beam calorimeters, and armor plates, cause a variety of surface effects which affect deleteriously the operation of such devices. Some of the major effects are discussed. (Author)

A80-16264 # The physics of closed cycle MHD power generation. L. H. T. Rietjens (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands). In: The physics of ionized gases; Summer School, 9th and Symposium, Dubrovnik, Yugoslavia, August 28-September 2, 1978, Invited Lectures and Progress Reports.

Belgrade, Institut za Fiziku, 1979, p. 753-771. 15 refs.

A historical review of research work in MHD power generation is followed by a discussion of the principle of an MHD steam power plant. The physics of closed cycle MHD power generation is outlined, and means of eliminating, or drastically reducing, all losses not inherent to the actual MHD conversion processes are examined. The problem of modelling the plasma in the MHD generator is analyzed.

V.P.

A80-16484 Dynamic suppression of ionization instability. A. P. Vinogradov and V. S. Filinov (Akademii Nauk SSSR, Institut Vysokikh Temperatur, Moscow, USSR). (*Teplotizika Vysokikh*

Temperatur, vol. 17, Mar.-Apr. 1979, p. 236-245.) *High Temperature*, vol. 17, no. 2, Sept. 1979, p. 201-208. 22 refs. Translation.

A method is considered for modeling switching of MHD devices of the Faraday and Hall type, taking into account the influence of the load on the effective plasma parameters. A linear and nonlinear analysis is carried out on the development and possible suppression of ionization instability in a plasma when the direction of the mean current vector changes periodically in the channel of an MHD device. Constraints are obtained on the values of the external load, Hall parameter, and frequency of change of the direction of current (caused by changing the type of switching of the MHD device) which are necessary both for complete and partial suppression of ionization instability. The calculated effective plasma parameters are compared with experimental data. (Author)

A80-16625 Photoconverter with bilateral sensitivity. Iu. A. Anoshin, N. M. Bordina, A. K. Zaitseva, V. A. Letin, and N. A. Milovanova (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istoknikov Toka, Moscow, USSR). (*Geliotekhnika*, no. 2, 1979, p. 3-8.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 1-7. 6 refs. Translation.

In the present paper, the current-voltage equations are derived for a photovoltaic cell with a n(+)-p-p(+) heterojunction, both for illumination of the isotopic junction and for simultaneous illumination of the isotopic and p-n junctions. The influence of the base and p(+) layer parameters on the performance of the cell is studied, and some experimental data are discussed. V.P.

A80-16626 Broadband varizone Ga/1-x/Al/x/As-Si-photoelectric converters with an illuminated n-region. A. Berkeliev, V. N. Bessolov, A. N. Imenkov, N. Nazarov, B. V. Tsarenkov, and Iu. P. Iakovlev (Akademiia Nauk SSSR, Fiziko-Tekhnicheskii Institut, Leningrad, USSR; Akademiia Nauk Turkmenskoi SSR, Fiziko-Tekhnicheskii Institut, Ashkhabad, Turkmen SSR). (*Geliotekhnika*, no. 2, 1979, p. 9-12.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 8-11. Translation. (Previously cited in issue 22, p. 4179, Accession no. A79-49180)

A80-16627 Photoelectric parameters of photoelectric converters in relation to illumination. E. B. Vinogradova, T. M. Golovner, S. M. Gorodetskii, and L. B. Kreinin (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istoknikov Toka, Moscow, USSR). (*Geliotekhnika*, no. 2, 1979, p. 13-17.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 12-16. 7 refs. Translation.

In the experiments described, the recombination characteristics and spectral sensitivity of photovoltaic cells were studied as a function of the illuminance level. The nature of bulk defects in the cell structure is studied for cells with a nonlinear lux-ampere characteristic. V.P.

A80-16628 Analysis of the optical characteristics of silicon photoelectric converters with bilateral sensitivity. V. R. Zaiavlin, V. A. Letin, and N. M. Kholeva (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Istoknikov Toka, Moscow, USSR). (*Geliotekhnika*, no. 2, 1979, p. 18-22.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 17-22. 7 refs. Translation.

In the present paper, the optical characteristics of bilaterally illuminated photovoltaic cells are analyzed with the object of assessing the effectiveness of their production technology and calculating their equilibrium temperature with allowance for infrared and reflected solar radiation. The results of the analysis can be used to control current losses and to modify the production technology. V.P.

A80-16629 Calculation of the optical characteristics of high-power two-mirror solar furnaces. S. A. Azimov, Kh. M. Mallaeva, I. I. Pirmatov, T. T. Riskiev, and S. Kh. Suleimanov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR). (*Geliotekhnika*, no. 2, 1979, p. 23-28.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 23-29. 9 refs. Translation.

Tashkent, Uzbek SSR). (*Geliotekhnika*, no. 2, 1979, p. 48-54.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 49-56. 7 refs. Translation.

A method of designing large solar furnaces is proposed. For illustration, the method is applied to the design of a two-mirror solar furnace and a tower-mounted solar plant. V.P.

A80-16630 On a calculation procedure for a heat accumulator in a solar heating system. O. Azimov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut, Tashkent, Uzbek SSR) and R. R. Avezov (Samarkandskii Gosudarstvennyi Universitet, Samarkand, Uzbek SSR). (*Geliotekhnika*, no. 2, 1979, p. 29-32.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 30-33. 6 refs. Translation.

A80-16631 Investigation of aerodynamic drag of solar air heaters. S. O. Khatamov, R. R. Avezov, and G. G. Umarov (Akademiia Nauk Uzbekskoi SSR, Fiziko-Tekhnicheskii Institut,

The paper deals with a theoretical and experimental study of the dynamic resistance of five representative solar air heaters of the hot box type. All the heaters studied were 1 m long, 0.64 m wide, and 0.175 m thick. Good agreement between theory and experiment is established. V.P.

A80-16632 Investigation of absorptive and radiative characteristics of an ideal selective surface. O. I. Kudkin and A. Abdurakhmanov. (*Geliotekhnika*, no. 2, 1979, p. 55-62.) *Applied Solar Energy*, vol. 15, no. 2, 1979, p. 57-64. 6 refs. Translation.

A method for calculating the absorptivity and emissivity of a selectively absorbing surface is proposed, along with a technique for calculating the optimal threshold wave length. An improved analytical definition of an ideal selective surface for solar heating purposes is given. V.P.

A80-16651 Prospects - A social context for natural science. W. S. von Arx (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *Oceanus*, vol. 22, Winter 1979-1980, p. 3-11. 12 refs.

Renewable global energy resources such as sunlight, photosynthesis, ocean thermal power, bioconversion of waste materials, wind, hydroelectric, and geothermal power, and the power from ocean movements (tides, currents, waves), each of which contains enormous amounts of energy in relation to present energy demands, are compared in terms of their relative power contents in this general presentation. Also discussed are the low-grade uses (e.g., space heating) of high-grade fuels such as electricity or nuclear power, and the problems stemming from waste disposal in the oceans and the storing of radionuclides, while food needs will require the proper resource management of fresh water, soil, and the marine aquaculture. J.P.B.

A80-16652 Energy from ocean thermal gradients. R. Cohen (U.S. Department of Energy, Washington, D.C.). *Oceanus*, vol. 22, Winter 1979-1980, p. 12-22. 13 refs.

Ocean Thermal Energy Conversion (OTEC) transforms the solar heating of the ocean surface into electrical energy, either transmitting it to shore or using it to manufacture energy-intensive products such as aluminum, ammonia, hydrogen or magnesium at sea. Open-cycle systems, requiring extremely large turbines and degasifiers, are not thought to be as advanced as closed-cycle systems which use heat exchangers (either shell-and-tube or plate) that are made of titanium, stainless steel or aluminum alloys, which must minimize corrosion and biofouling, and that use ammonia, propane or fluorocarbons as working fluids. OTEC platform configurations include ship shapes and submersibles, such as spar buoys, and require cold-water pipes 1,000 m long, made of such materials as elastomers, lightweight concrete and fiberglass-reinforced plastic. J.P.B.

A80-16653 The Coriolis program. P. B. S. Lissaman (AeroVironment, Inc., Pasadena, Calif.). *Oceanus*, vol. 22, Winter 1979-1980, p. 23-28.

The Coriolis array of 242 large turbines (each rated at 83 megawatts and approximately 170 m in diameter) moored in the

Gulf Stream (or, perhaps, Japan's Kuroshio Current) could produce about 10,000 megawatts at 4 cents per kilowatt-hour, assuming a plant factor of 57%. The central mechanism of the Coriolis system is a two-stage, 91-meter rotor consisting of a pair of counter-rotating turbines housed in a flared axisymmetric duct, and having catenary blade construction, whose tips are attached to circular rims driving electrical generators. As far as environmental effects are concerned, they would be approximately as follows: reduction in the speed of the Gulf Stream, 1.2%; thermal effects, on the order of 1/100,000 degrees C; maximum wake perturbation, 2 cm. J.P.B.

A80-16654 **Salt power - Is Neptune's ole salt a tiger in the tank.** G. S. Wick (Institute for Transcultural Studies, Los Angeles, Calif.). *Oceanus*, vol. 22, Winter 1979-1980, p. 29-37. 7 refs.

Methods of exploiting the 24 atm osmotic pressure difference between fresh and salt water to generate energy include reverse electro dialysis, wherein 80 millivolts of electricity cross each ion-selective membrane placed between solutions of fresh and salt water. Pressure-retarded osmosis, using pumps and pressure chambers, relies on semipermeable membranes that allow fresh water to flow into saline, with power generated by the permeated water being released through a turbine. In reverse vapor compression, water vapor rapidly transfers from fresh water to salt water in an evacuated chamber (due to the vapor pressure difference between them), and power can be extracted using 24 m diameter turbine blades. Environmental concerns include protecting estuaries from stress, managing sediments, and protecting marine animals, while filtration would be needed to keep the membranes free from corrosion, biological fouling, or silting. J.P.B.

A80-16655 **Power from ocean waves.** J. N. Newman (MIT, Cambridge, Mass.). *Oceanus*, vol. 22, Winter 1979-1980, p. 38-45. Navy-NSF-supported research.

Extracting some of the estimated two to three trillion watts of low-grade power from wind-generated surface waves is basically a matter of utilizing vertically-moving devices either submerged or on the waves. The dynamics of unidirectional wavemakers (oscillating or rotating) is discussed, since their geometry is identical to that of efficient wave absorbers. Specific configurations include simple, small point absorbers that can theoretically focus the incident wave energy from a capture width of about half a wavelength; and hinged vessels contouring to the waves and elongated in the direction perpendicular to the wave crests, power being extracted from the relative motion of the hinged subelements. Pneumatic wave absorbers using an oscillatory air column can amplify the air's motion with a nozzle before passing through a high-speed turbine, resulting in higher grade power. J.P.B.

A80-16656 **Fuels from marine biomass.** J. H. Ryther (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *Oceanus*, vol. 22, Winter 1979-1980, p. 48-58.

Seaweed and kelp are being investigated as possible large-scale sources of marine biomass for energy. By suspending seaweed in water, instead of near the bottom where it usually grows, the seaweed cultures maintain themselves permanently in a nonreproductive, nonfruiting stage, thereby continually vegetating. Under highly idealized test conditions (vigorous aeration, rapid exchange of seawater, frequent harvests and nutrient-enriched), the red seaweed *Gracilaria tikvahiae* yielded 35 g dry weight per sq. m daily, equivalent to 51 dry tons per acre yearly (with 50% ash content). The prospect of extensive offshore farms for growing plants on floating trays or woven into ropes near the surface is being studied by means of the 50 m long *Macrocystis pyrifera* kelp on a modular ocean test farm consisting of a 9 ft. diameter buoy attached to radial arms holding the kelp plants; nutrient-rich water is pumped from depths of 1,500 ft. J.P.B.

A80-16657 **Chemosynthetic production of biomass - An idea from a recent oceanographic discovery.** H. W. Jannasch (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *Oceanus*, vol. 22, Winter 1979-1980, p. 59-63. 8 refs.

Chemosynthetic production as a possibly important part of an ecosystem was verified when the first deep-sea thermal springs (a source of sulfide, which provides the needed electrons) were discovered at the Galapagos Rift, where large mussels, clams and many other invertebrates had supposedly been feeding on chemosynthetically-produced organic nutrients. A high concentration of ATP was found around the vents of the springs, as well as a high production of bacterial biomass. Some 200 strains of bacteria, all capable of oxidizing sulfur compounds, and numbering approximately 1 million cells per cubic centimeter of water, were found. A chemosynthetic aquaculture, using hydrogen sulfide (which is relatively inexpensive and easily available) as the source of electrons, has the advantage over photosynthesis that all environmental factors could be kept constant. J.P.B.

A80-16658 **Harnessing power from tides - State of the art.** P. R. Ryan. *Oceanus*, vol. 22, Winter 1979-1980, p. 64-67.

Instead of a conventional dam, a membrane of reinforced plastic (the 'water sail'), hermetically anchored to the bottom and sides of a bay, could harness power from tides. Such a membrane, constructed in sections, and estimated to be 20 to 30 times cheaper to construct than a conventional tidal project, could operate in a tidal range of two meters, instead of the usual five meters. Moreover, it could be lowered or pulled aside to allow ship traffic to pass or to protect it during storms. The top of the barrier would be supported by a cable (fixed to floats) spanning the entrance to the bay, while the conversion of tidal energy would be accomplished using compressed air, with two tidal chambers connected to a large piston air motor, although the possible use of gas turbine engines will also be tested. J.P.B.

A80-16718 **Particle beam systems in plasma diagnostics.**

H. P. Eubank (Princeton University, Princeton, N.J.). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978.* Oxford, Pergamon Press, Ltd., 1979, p. 17-34. 16 refs.

The paper reviews basic principles of active beam systems in plasma diagnostics, with emphasis on systems for the measurement of plasma potential, and current and impurity profiles. Attention is given to the following: determination of ion density and Z_{eff} ; beam dissociation and optical techniques; heavy ion beam probes; and tangentially injected neutral beam probes. B.J.

A80-16720 **Diagnostics for mirror machines.** J. E. Osher (California, University, Livermore, Calif.). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978.* Oxford, Pergamon Press, Ltd., 1979, p. 47-77. 40 refs. Contract No. W-7495-eng-48.

The neutral-beam-heated quasi-dc mirror confinement systems are described and a general example of mirror diagnostics is given by a discussion of the diagnostics used on the 2X11B experiment at the Lawrence Livermore Laboratory. Mirror machine diagnostics are then developed in more detail and attention is given to the special diagnostic needs of future mirror machines; emphasis is placed on diagnostics involving the higher-power neutral beams to be used with these future machines. B.J.

A80-16722 **Hard X-ray measurements.** H. Knoepfel (EURATOM and Comitato Nazionale per l'Energia Nucleare sulla Fusione, Frascati, Italy). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978.* Oxford, Pergamon Press, Ltd., 1979, p. 111-137.

44 refs.

A review of hard X-ray measurements performed on plasma confinement devices is presented. Attention is given to measurements of bremsstrahlung from plasma (thin targets), bremsstrahlung from solid (thick) targets, and recombination lines. The use of scintillation detectors, semiconductor detectors, and collimators to perform such measurements is considered, and attention is paid to energy measurements (pileup rejection system/data analysis) and flux measurements (energy resolution). B.J.

A80-16731 Measurements of the density fluctuations using the microwave scattering method. T. Tsukishima (Nagoya University, Nagoya, Japan). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978*. Oxford, Pergamon Press, Ltd., 1979, p. 255-270. 13 refs.

An expression is derived for microwave scattering from density fluctuations over a finite spatial region of a toroidal plasma. The accuracy of measurement is examined in terms of the finite scattering volume and observation time. In addition, measurements of scattering from nonstationary fluctuations are treated. A method for obtaining time-resolved spectra of fluctuations is described and applied to the determination of the temporal development of the electron temperature in a linear turbulent heating experiment. B.J.

A80-16745 Megavolt and megampere diagnostic techniques for pulsed power particle beam fusion drivers. M. S. Di Capua and D. G. Pellinen (Physics International Co., San Leandro, Calif.). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978*. Oxford, Pergamon Press, Ltd., 1979, p. 511-524. 24 refs. Research supported by the U.S. Department of Energy.

This paper describes electrical diagnostic techniques applicable to experiments with pulsed power particle beam fusion drivers. To display these techniques an experiment has been designed to investigate the propagation of a 0.1-TW power pulse in coaxial and triplate vacuum transmission lines with applied fields of 1 MV/cm, currents of approximately 100 kA, and voltages of 2 MV. Instrumentation was developed (1) to obtain a simultaneous measurement of the current on the ground as well as the high-voltage electrode at different positions along the transmission line; (2) to measure the input voltage to the transmission line, and the voltage at an arbitrary position on the triplate transmission line; (3) to measure the voltage in the field-emission diode at the output of the vacuum transmission line; (4) to measure the voltage in a resistive termination to the transmission line that could be used in the vacuum. The instruments and experimental techniques developed to acquire these kinds of data are discussed. (Author)

A80-16752 Survey of mirror machine reactors. W. C. Condit (California, University, Livermore, Calif.). In: *Diagnostics for fusion experiments; Proceedings of the Course, Varenna, Italy, September 4-16, 1978*. Oxford, Pergamon Press, Ltd., 1979, p. 651-680. 35 refs. Contract No. W-7405-eng-48.

The paper examines the Magnetic Mirror Fusion Program. Starting from the simple axisymmetric mirror concept the program overcame gross flute-type instabilities and the most serious micro-instabilities. Dense plasmas approaching the temperature range for fusion were produced, and extensive design studies of mirror configurations led to three designs: the standard mirror fission-fusion hybrid, tandem mirror, and the field-reversed mirror. Typical plasma parameters are given for each type of machine, concluding that in a working fusion reactor, diagnostics will be required for operational control. A.T.

A80-16760 # Magnetic field design for a large tokamak. G.-Y. Yu, J.-B. Chen, and Y.-P. Ho (Academia Sinica, Institute of Plasma Physics, Communist China). *Acta Physica Sinica*, vol. 28, Sept. 1979, p. 712-721. In Chinese, with abstract in English.

The paper summarizes methods of the magnetic field design of the CT-8 tokamak. The effect of various types of stray field on the equilibrium of the plasma torus was analyzed, the requirement which should be satisfied by the magnetic field was discussed, and an optimization method developed. In addition, the possibility of maintaining equilibrium during thermal rises was investigated. A.T.

A80-16776 Evidence of nonlinear processes from X-ray spectra of CO₂ laser-irradiated targets. H. Pépin, F. Martin, B. Grek, T. W. Johnston, J. C. Kieffer, and G. Mitchell (Québec, Université,

Varennas, Canada). *Journal of Applied Physics*, vol. 50, Nov. 1979, pt. 1, p. 6784-6788. 18 refs. Research supported by the National Research Council of Canada.

A study of the effects of nonlinear processes on X-ray emission by irradiation of CH₂, Al, and Pb targets with a focused CO₂ laser is presented. A multichannel X-ray spectrometer measured the X-ray spectrum from 1 to 50 keV; above a critical flux of 6 times 10 to the 12th power W/sq cm, the results show a change in slope of soft X-ray intensity vs laser flux, a change in the power-law dependence of hot temperature vs flux, an anisotropy of soft X-ray emission, and a strong production of energetic electrons. With the increasing Z number, there is no reduction of the effects of nonlinear phenomena, which appeared stronger with Al. A.T.

A80-16786 The A-1/1-y/B-1/y/C-IIID-VI/2x/E-VI2/1-x/pentenary alloy system and its application to photovoltaic solar energy conversion. J. Shewchun (McMaster University, Hamilton, Ontario, Canada; Brown University, Providence, R.I.), J. J. Loferski, R. Beaulieu (Brown University, Providence, R.I.), G. H. Chapman, and B. K. Garside (McMaster University, Hamilton, Ontario, Canada). *Journal of Applied Physics*, vol. 50, Nov. 1979, pt. 1, p. 6978-6985. 13 refs. Research supported by the National Research Council of Canada; Contract No. EG-77-C-1979.

The paper reports on investigation of pentenary alloy systems similar to the quarternary system in In(1-x)Ga(x)P(1-x)As(y). Such pentenary alloys are mixtures of ternary chalcopyrites of the I-III-VI₂ and II-IV-V₂ variety, and are of interest because they can improve the performance of heterojunction electrooptic devices such as solar cells. This improvement results because the pentenaries permit different semiconductor layers to be deposited on each other so that they are lattice and crystallographically matched, but also have independently adjustable band gaps. The Cu(1-y)Ag(y)InS₂(1-x)Se(2x) system appears to have the best potential for solar energy applications. Cathodoluminescence was used to determine band gaps, and the spectra indicate that all alloys are direct-band-gap semiconductors. Isolattice constant and band-gap contour maps were obtained for the system. A.T.

A80-16794 A theoretical evaluation and optimization of the radiation resistance of gallium arsenide solar-cell structures. B. T. Debney (Plessey-Caswell Research, Ltd., Allen Clark Research Centre, Towcester, Northants., England). *Journal of Applied Physics*, vol. 50, Nov. 1979, pt. 1, p. 7210-7219. 38 refs.

Theoretical treatments are used to analyze the performance of Ga(1-x)Al(x)As/GaAs heteroface and graded band-gap solar cells, and to study the radiation resistance of the two types of cell. The optimization of these solar-cell structures to tolerate radiation-induced degradation in electronic properties is discussed and their power-conversion efficiency evaluated. The calculations indicate only a marginally greater output from the graded band-gap cell compared to the conventional heteroface type for optimized structures. A comparison with the performance of a Si space cell under 1-MeV-electron irradiation is made which illustrates a superior performance from GaAs in respect of efficiency and radiation tolerance. (Author)

A80-16799 AlGaAs tunnel diode. S. M. Bedair. *Journal of Applied Physics*, vol. 50, Nov. 1979, pt. 1, p. 7267, 7268. 8 refs. U.S. Department of Energy Contract No. 07-7149; Contract No. F33616-78-C-2077.

An AlGaAs tunnel diode with a band gap of 1.6 eV has been fabricated. This diode provides a suitable connecting junction between the high- and low-band gap cells of a cascade solar-cell structure operating at several hundred suns concentration without causing any appreciable loss in efficiency. (Author)

A80-16948 # Reduction of aerodynamic drag and fuel consumption for tractor-trailer vehicles. V. U. Muirhead (Kansas, University, Lawrence, Kan.) and E. J. Saltzman (NASA, Flight Research Center, Edwards, Calif.). *Journal of Energy*, vol. 3, Sept.-Oct. 1979, p. 279-284. 12 refs. NASA-supported research.

Wind-tunnel tests were performed on a scale model of a cab-over-engine tractor-trailer vehicle and several modifications of the model. Results from two of the model configurations were compared with full-scale drag data obtained from similar configurations during coast-down tests. Reductions in fuel consumption derived from these tests are presented in terms of fuel quantity and dollar savings per vehicle year, based on an annual driving distance of 160,900 km (100,000 mi.). The projected savings varied from 13,001 (3435) to 25,848 (6829) liters (gallons) per year which translated to economic savings from \$3435 to about \$6829 per vehicle year for an operating speed of 88.5 km/h (55 mph) and wind speeds near the national average of 15.3 km/h (9.5 mph). The estimated cumulative fuel savings for the entire U.S. fleet of cab-over-engine tractor, van-type trailer combinations ranged from 4.18 million kl (26.3 million bbl) per year for a low-drag configuration to approximately twice that amount for a more advanced configuration. (Author)

A80-16952 # On the weathervaning of wind turbines. R. H. Miller (MIT, Cambridge, Mass.). *Journal of Energy*, vol. 3, Sept.-Oct. 1979, p. 319,320.

The paper discussed the static stability characteristics of horizontal-axis wind turbines that are free to pivot about a vertical axis. Consideration is given to the problem of a wind turbine in the upward position with a constant velocity in the opposite direction. However, there are no solutions given or analysis offered. C.F.W.

A80-16995 Efficiency improvements in bioenergy conversion systems. C. W. Lewis (Strathclyde, University, Glasgow, Scotland). *Energy Conversion*, vol. 19, no. 3, 1979, p. 125-131. 32 refs.

A discussion of the main bioenergy conversion systems is presented, including their respective efficiencies and how these are being improved. The concept of net energy analysis is also introduced as a guideline for determining system efficiencies and process selection. Combustion remains the most efficient conversion method for dry organic matter, with anaerobic digestion and ethanolic fermentations preferred for biomass containing a high percentage of water. The efficiencies of gasification, pyrolysis and the longer term proposition of biophotolysis are also covered.

(Author)

A80-16996 Influence of wall-jet gas injection on liquid-metal MHD generator performance. G. Fabris, E. S. Pierson, and R. L. Cole (Argonne National Laboratory, Argonne, Ill.). *Energy Conversion*, vol. 19, no. 3, 1979, p. 133-145. 6 refs. Research sponsored by the U.S. Department of Energy.

A80-16997 Simplified theory of nonuniform electrical conduction for an open cycle MHD generator with shaped magnetic induction. N. Kayukawa and Y. Ozawa (Hokkaido University, Sapporo, Japan). *Energy Conversion*, vol. 19, no. 3, 1979, p. 147-152. 7 refs.

A80-16998 Measurement of insolation using CdS photo-resistor. E. Klugmann (University of Nigeria, Nsukka, Nigeria; Gdansk, Politechnika, Gdansk, Poland) and O. E. Onyeogu (University of Nigeria, Nsukka, Nigeria). *Energy Conversion*, vol. 19, no. 3, 1979, p. 153-157.

A80-16999 The ampere-hour efficiency of photovoltaic solar generators. D. G. S. Chuah (University of Science, Penang, Federation of Malaysia). *Energy Conversion*, vol. 19, no. 3, 1979, p. 177-180. 7 refs. Research supported by the University of Science.

The charging power and discharge power of two photovoltaic solar generators are measured simultaneously with the sunshine hours. A comparison of these two powers shows that there is sufficient power under the available local sunshine for lighting purposes. The ampere-hour efficiency of these generators is compared with that of lead-acid and nickel-iron cells. A 10% difference in the ampere-hour efficiencies for the two generators is observed.

(Author)

A80-17004 # MHD boundary layer of the seeded combustion gas near cold electrodes. K. Okazaki, Y. Mori, K. Hijikata, and K. Ohtake (Tokyo Institute of Technology, Tokyo, Japan). *AIAA Journal*, vol. 18, Jan. 1980, p. 39-46. 7 refs.

The magnetohydrodynamic boundary layer of a seeded combustion gas around a cold electrode in a magnetohydrodynamic generator in the presence of a magnetic field is analyzed for the case when a current is applied by an external electric field. A three-fluid model is used to analyze the seeded combustion gas boundary layer for the cases of continuous and ideally segmented Faraday electrodes. It is shown that as the effective electrical conductivity perpendicular to the electrode surfaces is reduced by the magnetic field, the thicknesses of the low-electron-density region and the charge separation region increase, while for an ideally segmented electrode the deviation of the electron density from a Saha equilibrium value increases in laminar, however not in turbulent, flow. Linear stability theory is used to show that a perturbed propagating wave is generated by the effect of the magnetic field on the transition of the discharge from a diffuse mode to an arc mode, and that the stability of the diffuse discharge is degraded by the magnetic field. A.L.W.

A80-17064 # Legal and political problems of solar power stations in space. K. Wiewirowska (Polish Institute of International Affairs, Warsaw, Poland). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-IISL-03*. 6 p. 8 refs.

The future construction of Solar Power Stations (SPS) is discussed in the light of international and outer space law. According to the Outer Space Treaty of 1967, the free exploration and exploitation of outer space should be for the benefit and in the interests of all countries, and nations should not appropriate regions of outer space - particularly with regard to the placing of geostationary satellites, 283 of which are expected to be in orbit by 1990. Other obligations include avoiding terrestrial contamination, such as by microwave radiation beamed from an SPS, and fixing international liability with regard to objects falling to earth or colliding with other satellites. J.P.B.

A80-17126 Renewable energy prospects; Proceedings of the Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, January 9-12, 1979. Conference sponsored by the United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii. Edited by W. Bach (Münster, Universität, Münster, West Germany), W. Manshard (United Nations University, Tokyo, Japan), W. H. Matthews, and H. Brown (East-West Center, Honolulu, Hawaii). *Energy (UK)*, vol. 4, Oct. 1979. 321 p.

Papers are presented on the prospects of renewable alternative energy sources, with consideration given to the options for short- and long-range energy strategies, the potentials and constraints of individual renewable energy resources, and energy policies and strategies. Specific topics include the feasibility of large-scale alternative energy use by the year 2000, global perspectives for long- and short-range alternative energy strategies and the prospects of solar heating and cooling systems, satellite power systems, wind energy conversion systems, wave, current and tide power, OTEC, hydro power, petroleum plantations and geothermal energy systems. Attention is also given to the growth in energy demand, the implementation of energy conservation, the climatic impact of alternative energy sources, energy sources for rural development and the prospects for renewable energy options in developing nations. A.L.W.

A80-17127 Exploring alternative energy strategies. W. Bach (Münster, Universität, Münster, West Germany) and W. H. Matthews (East-West Center, Environment and Policy Institute, Honolulu, Hawaii). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel*

Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 711-722. 14 refs.

General considerations in the exploration of alternative energy strategies are presented. The increasing energy demand due to world population growth, economic growth, per capita energy consumption growth, unconventional resource development and urbanization is discussed, and the selection of the proper combination of fossil energy resources, nuclear energy resources and renewable energy resources is examined. The transition to such mixed energy strategies is considered, noting the technical, economic, social, political, and environmental areas that require analysis, and the controversial issues of the time scale, international relations, economic analysis, large-scale deployment, lifestyles and risks of the implementation of new strategies are outlined. The role of the technical community in the resolution of the energy problem is discussed, and a flexible energy strategy is recommended to accommodate the present state of uncertainty in future energy policy. A.L.W.

A80-17128 Can alternative energy resources be brought into large-scale use in the United States by the year 2000. H. Brown (East-West Center, Resource Systems Institute, Honolulu, Hawaii). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 723-731. 6 refs.

The replacement of crude oil and natural gas in the United States by the year 2000, when oil and gas production is expected to peak, by alternative energy sources, particularly synthetic crude oil made from coal, is examined, considering the interrelationships between the liquid fuel, gaseous fuel and electrical subsystems in industrialized countries. The cost of gasoline derived solely from synthetic natural gas produced from coal at a price of \$20 to \$30 per barrel is estimated to be at most less than gasoline costs in many countries, and a gradual program of gasoline tax rises is suggested to ease and finance a possible transition. The higher costs of ethanol and methanol produced from biomass as fuels are also considered, and the possibility and costs of producing three billion barrels of synthetic crude oil and 12 billion gallons of ethanol per year by the year 2000 are estimated. Modifications of the gaseous fuel subsystem by the use of methane derived from biomass and waste gasification is also considered, and the effects of these changes on the relative contributions of electrical energy sources and on world energy economics are assessed. A.L.W.

A80-17129 Global options for short-range alternative energy strategies. J. Goldemberg (São Paulo, Universidade, São Paulo, Brazil). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 733-744. 13 refs.

A discussion is presented on the possibilities of supplying the energy needs of the world and particularly of the developing countries on the basis of renewable resources: hydro power and biomass. Hydro power is found to be underused in many parts of the developing countries, and, up to the end of the century at least, 25 quads per year could be produced from this source. In addition, the unused annual increment of present-day forests could supply at least another 100 quads/year in developing countries. In industrialized countries only conservation can have a significant impact as an alternative strategy. (Author)

A80-17130 Global perspectives and options for long-range energy strategies. W. Haefele (International Institute for Applied Systems Analysis, Laxenburg, Austria). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 745-760.

An attempt is made to envisage the evolution of energy supply and demand for the next 50 yr. Seven identified world regions are considered in order to bring out their interrelationships and to provide a background against which national or regional energy strategies can be evaluated. The principal tool for doing this is the elaboration of two detailed and largely internally consistent scenarios. This permits us to make interpolations and extrapolations. The scenarios are only conceptualizations, not predictions. This paper addresses only the technical and substantive aspects of the energy problem and does not look into political, institutional, and societal problems. It is thus meant to serve as a basis for broader policy decision-making. (Author)

A80-17131 Global aspects of sunlight as a major energy source. J. M. Weingart (California, University, Berkeley, Calif.). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 775-798. 65 refs. Research supported by the Ford Foundation, International Institute for Applied Systems Analysis, Electric Power Research Institute, and University of California.

To achieve and sustain a decent livable world for all is a central goal for human society. While an abundant supply of energy is not in itself a determinant of such a world, it is nevertheless essential. A careful inquiry suggests that sunlight could eventually be the primary and even exclusive source of heat, electricity and synthetic fuels for the entire world, continuously and eternally on a scale (upwards of 100 TW) generally regarded possible only with fusion or with fission via the fast breeder. This could be achieved through a global network of solar conversion facilities coupled with appropriate energy transport and storage systems, and appears to be possible within acceptable constraints on energy payback time, materials and water resources, capital investment, and available suitable land. (Author)

A80-17132 Impacts of satellite power system technology. H. Moses (U.S. Department of Energy, Office of Health and Environmental Research, Washington, D.C.). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 799-809. 15 refs.

In the Satellite Power System (SPS) considered, energy from the sun is collected by an array 5 km x 10.5 km in area, located in geostationary orbit. The array contains either silicon or gallium aluminum arsenide photovoltaic cells whose output is transformed to 2.45 GHz microwaves. These are beamed to earth to a 10 km x 15 km rectifying antenna (rectenna) which rectifies the microwaves and interfaces the power with utility power lines. Each unit will produce 5 million kW of electrical power (5GWe). Sixty such units are planned at the rate of two per year over 30 yr. The paper deals with an assessment of both the environmental and societal aspects of an SPS. Under environmental aspects, attention is devoted to the health and ecological effects of both microwave radiation and other effects. The interaction of microwaves with the atmosphere is examined particularly as it affects communication. Nonelectromagnetic radiation effects such as noise and increased pollution are also considered. (Author)

A80-17133 An analysis of the potential of wind energy conversion systems. J. W. Reed (Sandia Laboratories, Albuquerque, N. Mex.). (*United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.*) *Energy* (UK), vol. 4, Oct. 1979, p. 811-822. 31 refs.

Wind energy conversion systems (WECS) are solar systems because the sun drives the atmospheric circulation. An average 500 GW of electricity could be generated by massive exploitation of the U.S. Great Plains wind field. There are, however, large fluctuations in available wind power. Gusts and turbulence also require filtering to meet normal power requirements. Several schemes are evolving to

tame this erratic wind power supply. Modern technology is refining horizontal-axis turbines of a wide size range. Progress is also being made toward producing an economical vertical-axis turbine. Standards for turbine performance evaluation and installation site selection are now being developed. Eventually, mass-produced WECS may cost \$1000 per installed, rated kW, but the wind does not often flow at turbine-rated speed. With some storage or filtering, problems with wind variability may be overcome. (Author)

A80-17134 Waves, currents, tides - Problems and prospects. A. Voss (Kernforschungsanlage Jülich GmbH, Jülich, West Germany). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 823-831. 13 refs.

A quantitative estimation of the energy potential of ocean surface waves, ocean currents and tides and a review of the techniques for utilizing these renewable energy sources, their present state of development and their economic and environmental aspects are presented. The potential of wave power, which is in the order of 1-10 TW, could become a significant source of energy in regions of the world with favorable wave conditions, such as the United Kingdom and Japan. All wave-power schemes investigated today are in early stage of development, and require more research to become commercially available. The prospects for utilizing ocean currents are relatively unattractive due to the small resource base and the possible environmental effects. Although tidal mills have been used since the eleventh century, today only one sizable tidal power plant has been built, the 240 MWe Rance Tidal Power Station in France. The overall potential of tidal energy is about 3 TW, but only in certain locations of the world do the natural conditions promise technical and economic viability. (Author)

A80-17135 Ocean thermal energy conversion /OTEC/ - Social and environmental issues. A. Lavi (Carnegie-Mellon University, Pittsburgh, Pa.) and G. H. Lavi (ERDI, Inc., Pittsburgh, Pa.). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 833-840. 13 refs.

Economic, social and environmental issues in the commercialization of OTEC are addressed, assuming technical feasibility and cost competitiveness, at least in certain areas. The market potential of OTEC on U.S. islands and in near-shore regions of the mainland is assessed and the economics of commercialization are considered. It is concluded that the private ownership of OTEC plants and facilities is not likely without government financial incentives, and the nature of possible incentives is outlined. Environmental problems of OTEC are discussed, noting ocean water mixing, chemical leakages, CO₂ release from deep cold water and the presence of large numbers of plants and electric cables, and institutional questions of baseload OTEC plant licensing, regulation, world market impact and labor requirements are considered. It is concluded that OTEC represents a beneficial long-term option. A.L.W.

A80-17136 The application potential of hydro power. E. J. Jeffs. (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 841-849. 6 refs.

The potential for the future application of hydroelectric power, the only renewable alternative energy source with already established large-scale technology, is discussed. The scenario of a totally electric energy society in which heat can be produced as a byproduct of electricity generation is presented, and means for the expansion of hydropower installations are considered. It is suggested that small hydro plants with capacities between 1 and 10 MW could be used to meet local energy demands, pumped storage may be used to

accommodate peak demands and provide back-up energy storage, and hydropower potential can be exploited in remote regions and developing nations, possibly even by the exploitation of glacial run-off. The economic and political aspects of the development of an energy trade on the basis of new hydropower installations in remote regions are also considered. A.L.W.

A80-17137 Petroleum plantations and synthetic chloroplasts. M. Calvin (California, University, Berkeley, Calif.). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 851-869. 22 refs. Research sponsored by the U.S. Department of Energy.

The use of green plants as energy capturing and material storage devices is reviewed and the development of synthetic devices based on green plant photosynthesis to capture solar energy and convert it directly into long-lived useful substances is discussed. The conversion of plant-produced carbohydrates into a more reduced form by anaerobic fermentation is examined, taking into account the Brazilian program of sugar cane and manioc conversion to alcohol for fuel, and the development of plantations of plants of the Euphorbiaceae family, which reduce carbon dioxide to hydrocarbons directly, is surveyed. Attempts to artificially reproduce the photosynthetic membrane process of electron transfer without the use of water for agriculture by the construction of separate micelles containing each reaction of the quantum absorption process, the induction of photoelectron transfer from a donor other than water, electron exchange between the two systems, and the separation of oxygen are presented. Such synthetic membrane systems would be capable of capturing solar energy and storing it indefinitely. A.L.W.

A80-17138 Prospects of future geothermal energy development. J. Suyama (Geological Survey of Japan, Kawasaki, Japan). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 871-879. 28 refs.

Prospects for the future development of the world's geothermal energy resources are analyzed. It is shown that of the three types of geothermal resources available (hydrothermal convection, hot igneous systems and regional conductive environments), only high temperature hydrothermal convection presently has the proven technology to be commercially attractive for electric power generation. Problems in the development of hydrothermal resources in Japan and the United States for electricity generation are presented, and the use of geothermal resources for nonelectrical purposes is considered. Environmental, institutional and legal aspects of the use of geothermal energy are discussed, and it is concluded that the full exploitation of potential geothermal resources requires the improvement of exploration and assessment technology, the development of appropriate technology for utilizing these resources and the removal of many institutional constraints. A.L.W.

A80-17139 Comparative risk assessment of energy systems. S. H. Schneider (National Center for Atmospheric Research, Boulder, Colo.). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 919-931.

The issue of risk assessment is addressed and results of a detailed analysis performed by the National Academy of Sciences Committee on Nuclear and Alternative Energy Systems of the health, environmental and socio-political risks associated with various energy alternatives are summarized. Consideration is given to the measurement of risks, the spatial and temporal heterogeneity of risks, marginal risks and benefits, the comparison of risks among activities with different benefits, the discounting of future risks, the percep-

tion of risks by the public and the uncertainties in risk assessment. Tables of the risks of nuclear, coal, oil, gas, hydroelectric, geothermal and solar energy systems are presented which demonstrate that no form of energy production is without risk. It is also concluded that our methods of risk analysis must be improved to cope with the diversity of risks and benefits associated with energy systems, that diversity in energy sources will provide some protection against unforeseen risks, and that, because of the inherent risks, it should be attempted to minimize global energy usage. A.L.W.

A80-17140 Climatic impact of alternative energy sources. J. Williams (National Center for Atmospheric Research, Boulder, Colo.). (United Nations University, East-West Center, International Institute for Applied Systems Analysis, and University of Hawaii, Conference on Non-Fossil Fuel and Non-Nuclear Fuel Energy Strategies, Honolulu, Hawaii, Jan. 9-12, 1979.) *Energy* (UK), vol. 4, Oct. 1979, p. 933-939. 14 refs. Research supported by the United Nations Environmental Programme.

The impact on the climate of the large-scale deployment of solar energy conversion systems, including OTEC and biomass conversion, to meet a future energy demand of 25 to 40 TW is estimated. The effects of solar thermal electric conversion systems on the surface energy balance, surface roughness and surface wetness of the earth are discussed. It is also shown that photovoltaic conversion could act as a local heat source, OTEC systems would modify the ocean temperature distribution, ocean currents, atmospheric CO₂ content and ocean surface albedo, and the cultivation and conversion of plant biomass could cause large-scale changes in surface and atmospheric characteristics. The necessity of further climate research to better quantify these effects is pointed out and the adoption of a flexible energy strategy is suggested. A.L.W.

A80-17218 Ablation of solid hydrogen in a plasma. L. W. Jorgensen (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon; Imperial College of Science and Technology, London, England) and A. H. Sillesen (EURATOM and Riso National Laboratory, Roskilde, Denmark). *Journal of Physics D - Applied Physics*, vol. 12, Dec. 14, 1979, p. 2145-2153. 29 refs. Research supported by the Statens Naturvidenskabelige Forskningsrad.

Several hydrogen pellet ablation models based on the formation of a shielding neutral cloud have been reported by different authors. The predicted ablation rates are shown to follow almost the same scaling law and this is used to explain our ablation experiment.

(Author)

A80-17222 The present status of coal gasification following the 14th World Gas Congress - Toronto 1979 (Point sur la gazéification du charbon après le 14e Congrès Mondial du Gaz - Toronto 1979). P. Gaussens (Gaz de France, Paris, France). *Revue de l'Energie*, vol. 30, Nov. 1979, p. 905-922. In French.

The objectives of coal gasification are discussed and various processes are examined. Consideration is given to the advantages of using gas derived from coal rather than solid or fluidized coal in small-scale installations and coal gasification products required for space heating, water heating, small industries and heavy industry are outlined. Processes of oxyvapogasification and hydrogenation for the production of natural gas and industrial gases from coal are reviewed and evaluated with attention given to autothermic oxyvapogasification for industrial gas production and for industrial gas and synthetic natural gas production, autothermic hydrogenation processes, allothermic oxyvapogasification and hydrogenation processes and methanation processes. A.L.W.

A80-17223 The policy of the European Economic Community in the field of energy savings (La politique de la communauté économique européenne dans le domaine des économies d'énergie). J. Carrière. *Revue de l'Energie*, vol. 30, Nov. 1979, p. 912-916. In French.

Policies of the European Economic Community from before the oil crisis of 1973 to the present with respect to energy savings are reviewed. The lack of response to the 1971 Report to the Club of Rome indicating the risks which could result from excessive economic growth, the report of the United States National Petroleum Committee concluding that energy savings should be a national goal and the position of the European Economic Community stressing the utilization rather than the acquisition of energy in May, 1973, are discussed. Actions taken by the Community in response to the crisis following the 1973 Arab-Israeli conflict to reduce the consumption of energy are then outlined, including the emergency measures taken by various countries at the time of the crisis and the results of community and national studies of long-term steps to be taken in the domestic, transportation and industrial sectors to ensure the availability of energy. It is concluded that events in the oil exporting countries render imperative the implementation of a policy of energy savings in Europe. A.L.W.

A80-17227 Energy conservation - Aerodynamic drag reduction of intercity buses. N. L. Nihan (Washington, University, Seattle, Wash.) and M. C. Sullivan (Boeing Commercial Airplane Co., Renton, Wash.). *Journal of Advanced Transportation*, vol. 13, Fall 1979, p. 17-23. 9 refs.

An uncertain energy supply and rising fuel prices point toward a need for energy conservation techniques in intercity travel. One economical means of conserving fuel is through the reduction of aerodynamic drag for intercity buses. This can be achieved by the use of very simple add-on devices such as guidevanes and front and side curtains. Tests indicate that a 40 percent reduction in drag could be achieved in this way. This would mean overall fuel savings of nearly 20 percent. Thus, net income for companies specializing in intercity travel would increase substantially through use of these devices.

(Author)

A80-17236 Geology of the Athabasca oil sands. G. D. Mossop (Alberta Research Council, Geology Div., Edmonton, Canada). *Science*, vol. 207, Jan. 11, 1980, p. 145-152. 21 refs.

In-place bitumen resources in the Alberta oil sands are estimated at 1350 billion barrels. Open-pit mining and hot water extraction methods, which involve the handling of huge tonnages of earth materials, are being employed in the two commercial plants now operating. In situ recovery methods will be required to tap the 90 percent of reserves that are too deeply buried to be surface mined. Development of in situ technologies will be painstaking and expensive, and success will hinge on their compatibility with extremely complex geological conditions in the subsurface. (Author)

A80-17241 Ethyl alcohol production and use as a motor fuel. Edited by J. K. Paul. Park Ridge, N. J., Noyes Data Corp. (Energy Technology Review, No. 50; Chemical Technology Review, No. 144), 1979. 366 p. \$48.

The book presents an economic assessment of possible modes of preparation of ethanol from various forms of biomass, natural resources and their waste materials or by-products. A chapter on current technology is also included. The present and potential availability of biomass from sugar crops, grains and grasses and silviculture is considered. Current crop production, proposed crops grown specifically for energy production, and crop wastes and residues are discussed. Finally, to determine the actual practicality of fueling motor vehicles with ethanol, either 100% or in blends, several sets of engine test data are reviewed. The results seem favorable, 10 to 20% ethanol blends performing very similarly to straight gasoline with slight gains in octane rating and mileage. S.D.

A80-17243 # Brightness distribution over the solar disk (Raspredelenie iarkosti po solnechnomn disku). K. O. Annaniiazov, V. A. Baum, and S. O. Mamedniiazov (Akademiia Nauk Turkmenkoi SSR, Institut Solnechnoi Energii, Turkmen SSR). *Akademiia Nauk Turkmenkoi SSR, Izvestiia, Seria Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1979, p. 26-29. 7 refs. In Russian.

A basic characteristic of concentrating mirror systems is radiant flux density distribution over the receiver surface. In precise mirror systems, this distribution is formed by superposition of solar images projected by the individual elements of the mirror surface onto the focal plane. In the present paper, interpolational analytical expressions are derived for the brightness distribution over the solar disks within various spectral ranges. V.P.

A80-17244 # Solar system with a hermetically and nonhermetically vitrified regenerative heater and its energetic indices (Gelioustanovka s negermetichno i germetichno osteklenym regeneratorem-nagrevatelem i ee energeticheskie pokazateli). A. Khandurdyev, A. Kakabaev, and Ch. Kurbankuliev (Turkmenkii Gosudarstvennyi Universitet, Ashkhabad, Turkmen SSR). *Akademiia Nauk Turkmenkoi SSR, Izvestiia, Serii Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1979, p. 30-36. In Russian.

A80-17245 # Results of interdepartmental tests of solar water heaters over an annual cycle. I (Rezultaty godichnogo tsikla mezhvedomstvennykh ispytaniy solnechnykh vodonagrevatelei. I). R. Bairamov, A. D. Ushakova, A. Khodzhaev, N. A. Kuladova, and O. Annaklycheva (Akademiia Nauk Turkmenkoi SSR, Institut Solnechnoi Energii, Turkmen SSR). *Akademiia Nauk Turkmenkoi SSR, Izvestiia, Serii Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1979, p. 37-44. In Russian.

The paper deals with the measurement techniques and types of solar water heaters used in tests conducted by several organizations over a period of one year. Measurements of the total solar radiation at the heat-receiver surface are tabulated, along with the parameters of the water heaters tested. V.P.

A80-17246 # Algorithm for calculating the shading and blocking of the heliostats of a solar electric power plant (Algoritm rascheta zatneniia i blokirovki geliostatov solnechnoi elektricheskoi stantsii /SES/). I. V. Baum and S. O. Mamednizov (Akademiia Nauk Turkmenkoi SSR, Institut Solnechnoi Energii, Turkmen SSR). *Akademiia Nauk Turkmenkoi SSR, Izvestiia, Serii Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1979, p. 97-100. In Russian.

A80-17247 # Structure of an averaged statistical pencil of rays reflected from a heliostat (Struktura srednestatisticheskogo puchka luchej, otrazhennogo ot geliostata). I. V. Baum and S. O. Mamednizov (Akademiia Nauk Turkmenkoi SSR, Institut Solnechnoi Energii, Turkmen SSR). *Akademiia Nauk Turkmenkoi SSR, Izvestiia, Serii Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk*, no. 5, 1979, p. 100-102. In Russian.

An important characteristic of the optical system of a solar power plant is the collection coefficient of radiation reflected from the heliostats. In view of the variety of existing heliostat versions, the present analysis is carried out for the reflected averaged statistical pencil of rays, whose formation is influenced by noncorrelated heliostat errors and the angular errors of the orientation systems. V.P.

A80-17252 # Ion-stimulated sorption of nitrogen on a continuously deposited titanium film. G. I. Grigorov, I. N. Martev, and K. K. Tsatsov (B'lgarska Akademiia na Naukite, Institut po Elektronika, Sofia, Bulgaria). *Bolgarskaia Akademiia Nauk, Doklady*, vol. 32, no. 8, 1979, p. 1069-1072. 7 refs.

Currently, a number of important technologies rely on the use of metal-metalloid compounds with a high metalloid content. The present paper deals with the preparation of TiN(x)-type compounds with x values higher than 1.15. The principal results of ion-stimulated nitrogen sorption on a continuously deposited titanium film are described, and characteristic parameters of sorption on continuously deposited getter films are identified. V.P.

A80-17307 Numerical computation of singular control problems with application to optimal heating and cooling by solar energy. H. J. Oberle (München, Technische Universität, Munich, West Germany). *Applied Mathematics and Optimization*, vol. 5, no. 4, 1979, p. 297-314. 25 refs.

The method presented here is an extension of the multiple shooting algorithm in order to handle multipoint boundary-value problems and problems of optimal control in the special situation of singular controls or constraints on the state variables. This generalization allows a direct treatment of (nonlinear) conditions at switching points. As an example a model of optimal heating and cooling by solar energy is considered. The model is given in the form of an optimal control problem with three control functions appearing linearly and a first order constraint on the state variables. Numerical solutions of this problem by multiple shooting techniques are presented. (Author)

A80-17343 Thionine coated electrode for photogalvanic cells. W. J. Albery, A. W. Foulds, K. J. Hall, A. R. Hillman (Imperial College of Science and Technology, London, England), R. G. Egde, and A. F. Orchard (Oxford University, Oxford, England). *Nature*, vol. 282, Dec. 20-27, 1979, p. 793-797. 13 refs.

The characteristics of a thionine-coated illuminated electrode in a photogalvanic cell intended for solar energy conversion are investigated. Pt and SnO₂ electrodes were coated with a stable layer of thionine by holding them at 1.1 to 1.5 V in a thionine solution for several minutes, and the electrode kinetics of various redox couples were examined. Current-voltage curves indicate that the reductions of thionine and its disulphonated derivative are reversible on a clean Sn or Pt electrode and nearly reversible on a coated electrode, while the coating has little effect on the reduction of quinone. For inorganic couples, the coating is found to greatly reduce the kinetics of Fe(III), Fe(CN)₆(-4), Ru(2,2 prime bipyridine)3(+3) and Ce(IV) reduction. Coating voltages and times are also found to affect electrode kinetics. The inhibition of inorganic reduction by the coating is explained by the blockage of single electron transfers to the ion. It is concluded that the thionine-coated electrode has the required selectivity to act as the illuminated electrode in an iron-thionine galvanic cell. A.L.W.

A80-17352 # The relative value of energy derived from municipal refuse. R. S. Hecklinger (Charles R. Velzy Associates, Inc., Armonk, N.Y.). *ASME, Transactions, Journal of Energy Resources Technology*, vol. 101, Dec. 1979, p. 251-255; Discussion, p. 255-258; Author's Closures, p. 258-259. 14 refs.

Many systems for utilizing the heat energy in municipal refuse are in various stages of development. These systems either use unprocessed solid waste as a fuel or derive a fuel through processing. The fuels produced vary radically in heating value. The energy expended in processing differs from one process to another and the potential end use is not the same for each system. Six representative systems are compared to determine the relative potential value of refuse as a source of energy. (Author)

A80-17573 Solar-hydrogen energy systems. Edited by T. Ohta (Yokohama National University, Yokohama, Japan). Oxford and New York, Pergamon Press, 1979. 276 p. \$35.

The use of solar energy to produce hydrogen for use as a fuel is examined, with particular emphasis on processes for the splitting of water by sunlight. Consideration is given to the thermodynamics of watersplitting, and to the electrolysis and direct thermal decomposition of water. Thermochemical, photochemical, photoelectrochemical and biological and biochemical hydrogen production processes are presented and evaluated, and the concept of a system for the direct conversion of solar energy at sea by a general process for splitting of sea water is detailed. The storage of solar energy in the form of metal hydrides is also treated. A.L.W.

A80-17574 Introduction - A review of the scope. T. Ohta (Yokohama National University, Yokohama, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 1-23. 51 refs.

The significance, solar technology, processes and utilization of solar energy systems used to produce hydrogen are reviewed. Attention is given to the role of solar hydrogen energy systems within desirable future energy networks and chemical manufacturing industries, and the various types of solar collectors, including reflectors, refractors and flat plates. Direct (photolytic, thermal decomposition, biophotolytic) and indirect (electrolytic, by means of solar-generated electricity) processes of hydrogen acquisition from water are presented, taking into account various possible means of separating resultant water, hydrogen and oxygen mixtures. The utilization of hydrogen in advanced energy systems, as a chemical feedstock, as an agent in materials manufacturing and in the transportation sector is discussed. A.L.W.

A80-17575 Thermodynamics of water-splitting. T. Ohta (Yokohama National University, Yokohama, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 25-33. 7 refs.

The thermodynamics of water decomposition are examined with particular emphasis on thermochemical processes to be used in solar-powered systems. The structure and vibration of the water molecule are discussed, and its thermodynamic parameters, including heat of formation and changes in Gibbs free energy, entropy and enthalpy upon dissociation in the vapor state, are considered. Chemical cycles for the decomposition of water are discussed, noting the advantages of a scheme which does not require useful work, and the thermal efficiencies of the thermochemical decomposition of water and of hybrid (using thermal and nonthermal energy) cycles are examined. A.L.W.

A80-17576 Water electrolysis. T. Takahashi (Nagoya University, Nagoya, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 35-58. 20 refs.

The electrolysis of water is evaluated as a potentially efficient, low cost means of hydrogen production. The theoretical energy and voltage, current, and energy efficiencies of water electrolysis are considered. The present status of water electrolysis is reviewed, with attention given to caustic potash of soda electrolytes, electrode materials, diaphragms inserted between the electrodes, and the design of unipolar and bipolar cells. Current electrolytic cells are presented and their performances are compared. Advanced high-efficiency electrolysis systems, including the Teledyne Energy Systems bipolar filter press cell, the static feed water electrolyzer, solid polymer electrolyte water electrolysis systems, high temperature solid electrolyte water electrolyzers and palladium electrode electrolyzers are described, and their potential performances are compared. Problems in the direct electrolysis of sea water are indicated, and it is concluded that water electrolysis is expected to become one of the principle means of producing large quantities of hydrogen. A.L.W.

A80-17577 Direct thermal decomposition of water. S. Ihara (Ministry of International Trade and Industry, Electrotechnical Laboratory, Tokyo, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 59-79. 19 refs.

The thermodynamics of the direct thermal decomposition of water are treated, and practical aspects of the application of solar energy as a heat source are examined. The thermodynamics of the two-step dissociation of water at temperatures less than 6000 K are discussed, with attention given to the translational, rotational, vibrational and electronic partition functions, the equilibrium composition of the gaseous products, the net energy requirements of the process, and its thermodynamic efficiency. The technical requirements of a solar system which would supply operating temperatures greater than 1500 K for decomposition in order to maximize its efficiency are examined, and possible techniques for the separation of the gas mixtures produced by the thermal decomposition of water

are compared. Experimental studies of the decomposition of water using a solar furnace and of high-temperature separation membranes are reported, and it is concluded that extensive development of a separation process is necessary for the systems analysis of solar water thermal decomposition systems. A.L.W.

A80-17578 Thermochemical hydrogen production. S. Sato (Japan Atomic Energy Research Institute, Takasaki Radiation Chemistry Establishment, Tokai, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 81-114. 53 refs.

Thermochemical methods of hydrogen production by the decomposition of water are discussed. The development of thermochemical processes which would lead to the formation of hydrogen from water is reviewed, and the use of nuclear and solar heat sources for thermochemical processes is discussed. One-step and two-step processes for water decomposition are examined, discussing the thermodynamics of the overall process, the amount of energy recoverable, and the energy requirements of ideal and nonideal processes. Thermochemical reaction sequences for water decomposition, hydrogen generation, oxygen generation and the regeneration of intermediates are presented, including iron-halide and sulfur dioxide-iodine reaction families. Consideration is also given to the technical and overall evaluation of possible thermochemical processes for hydrogen production. A.L.W.

A80-17579 Photochemical hydrogen production. M. Kamiya and T. Ohta (Yokohama National University, Yokohama, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 115-135. 27 refs.

The photochemical production of hydrogen from water using solar radiation as the light source is discussed. Catalytic and energetic requirements of photochemical decomposition and the electron transfer spectra of candidate catalyst ions are considered, and photochemical water dissociation reactions are classified into one-photon hydrogen-radical-forming systems, one-photon hydroxy-radical-forming systems, one-photon hydrogen-and-oxygen-forming systems and two-photon hydrogen-and-oxygen-forming systems. Specific proposed photochemical and hybrid water-splitting processes are outlined, including the hybrid Yokohama Mark 5 and 6 cycles which complete the chemical cycle using photochemical as well as thermochemical and/or electrochemical reactions, hydrogen production by the Ce(II)/Ce(III) redox reaction, the ruthenium, rhodium, and copper complex systems, the silver zeolite process and highly organized simulated membrane systems. A.L.W.

A80-17580 Photoelectrochemical hydrogen production. T. Watanabe, A. Fujishima, and K. Honda (Tokyo University, Tokyo, Japan). In: Solar-hydrogen energy systems. Oxford and New York, Pergamon Press, 1979, p. 137-169. 106 refs.

Principles of and recent advances in the conversion of sunlight to fuel and electricity by means of systems based on semiconductor-liquid junctions, including biophotoelectrochemical processes, are reviewed. The generation of electron-hole pairs at a semiconductor electrode in a photoelectrochemical cell and the resulting oxidation and reduction reactions in the cell are examined, noting the applicability of the system to the splitting of water and the production of hydrogen. Possible fuel-producing cells are considered, including the already demonstrated titanium dioxide/platinum electrode water-splitting cell, and discussed in terms of the stability, flatband potential, bandgap and quantum efficiency requirements of the process. The stabilization of small-bandgap semiconductor electrodes by the addition of redox species to the solution in a regenerative electrochemical photovoltaic cell is examined, and a hybrid system consisting of a combination of an electrolytic cell with a photodecomposition cell is presented. Consideration is given to photosynthetic water splitting in the presence of light, and in vitro processes based on chloroplast activity. Photoelectrocatalytic processes for hydrogen production, nitrogen reduction and carbon dioxide reduction and dye-semiconductor systems are also examined. A.L.W.

A80-17581 Biological and biochemical hydrogen production. A. Mitsui (Miami, University, Coral Gables, Fla.). In: *Solar-hydrogen energy systems*. Oxford and New York, Pergamon Press, 1979, p. 171-191. 166 refs.

The production of hydrogen by intact microorganisms and cell-free biochemical systems using solar energy is discussed. Current understandings of the photoproduction of hydrogen by algae and photosynthetic bacteria are reviewed, and work with cell-free systems consisting of chloroplasts, biological electron carriers and bacterial hydrogenase is summarized, noting the feasibility of using hydrogen photoproduction by algae as a source of fuel. Means of increasing the efficiency of biological hydrogen photoproduction in living cells and cell-free systems are surveyed, and the utilization of photosynthetically produced materials for a variety of applications including biomass, fertilizer, methane, pharmaceuticals and chemicals is considered as a means of increasing the economic potential of the process. Increased research and development in the field of hydrogen photoproduction is suggested as a means leading to the production of clean, renewable energy. A.L.W.

A80-17582 Solar energy storage by metal hydride. S. Ono (National Chemical Laboratory for Industry, Tokyo, Japan), M. Yamaguchi, and T. Ohta (Yokohama National University, Yokohama, Japan). In: *Solar-hydrogen energy systems*.

Oxford and New York, Pergamon Press, 1979, p. 193-224. 14 refs.

Metal hydride systems for long-term solar thermal energy storage are examined. Various materials for solar heat storage for architectural applications are reviewed, including water, pebble beds, insulators such as rock wool, glass wool and synthetic resins, molten salts and reaction heat storage systems, of which the metal hydride system is considered the most effective. The thermodynamics of metal hydride systems for hydrogen or heat storage are discussed, and the characteristics of some representative systems, namely iron-titanium hydrides, magnesium-nickel hydrides and lanthanum-nickel hydrides, are considered. Results of performance tests of the endothermic and exothermic processes of an iron-titanium system are reported and the HYSOS hydride conversion and storage system, which employs two types of hydrides, is presented. An ideal heat engine based on the metal hydriding reaction is examined theoretically and a promising prototype chemical engine based on LaNi₅H₆ is described. A.L.W.

A80-17583 Direct solar energy conversion at sea. W. J. D. Escher (Escher Technology Associates, St. Johns, Mich.) and T. Ohta (Yokohama National University, Yokohama, Japan). In: *Solar-hydrogen energy systems*. Oxford and New York, Pergamon Press, 1979, p. 225-248. 11 refs.

Hydrogen production and delivery from direct solar energy conversion facilities located at sea is treated, assuming the use of a heat engine/electricity generation/water electrolysis system. The concept of ocean energy is discussed, noting the distinction between direct and indirect solar energy conversion at sea, and direct solar energy conversion is considered within the framework of the seaward advancement of industrial societies. Results of preliminary experiments on a PORSHE (Planned Ocean Raft System for Hydrogen Economy) device are reported, and the advantages and disadvantages of locating large-scale solar energy systems at sea are discussed, noting as well the possible association of marine farming installations with energy facilities. The potential of solar hydrogen systems is assessed, and an illustrative model of an ocean-based direct solar energy conversion system for hydrogen energy production is described. The significance of hydrogen energy to other sectors of the energy economy is also examined. A.L.W.

A80-17710 Tetrachlorodibenzo-p-dioxin quantitation in stack-collected coal fly ash. B. J. Kimble (California, University, Davis, Calif.) and M. L. Gross (Nebraska, University, Lincoln, Neb.). *Science*, vol. 207, Jan. 4, 1980, p. 59-61. 26 refs. Research supported by the U.S. Environmental Protection Agency; NSF Grant No. CHE-78-18572; Contract No. DE-AM03-76SF00472.

Gas chromatography-high resolution mass spectrometry has been used to quantitate tetrachlorodibenzo-p-dioxin (TCDD) in fly ash collected from the stack of a typical commercial coal-fired power plant. No TCDD was detected in this fly ash, but minute traces may be present below the detection limit of 1.2 parts per trillion (by weight). This finding indicates that this type of fossil-fueled power plant is not a large source of this compound in environmental samples, in contrast to the conclusions presented in a recent industrial report. (Author)

A80-17737 * # Preparing aircraft propulsion for a new era in energy and the environment. W. L. Stewart, D. L. Nored, J. S. Grobman, C. E. Feiler, and D. A. Petrash (NASA, Lewis Research Center, Cleveland, Ohio). *Astronautics and Aeronautics*, vol. 18, Jan. 1980, p. 18-31, 37. 22 refs.

Improving fuel efficiency, new sources of jet fuel, and noise and emission control are subjects of NASA's aeronautics program. Projects aimed at attaining a 5% fuel savings for existing engines and a 13-22% savings for the next generation of turbofan engines using advanced components, and establishing a basis for turboprop-powered commercial air transports with 30-40% savings over conventional turbofan aircraft at comparable speeds and altitudes, are discussed. Fuel sources are considered in terms of reduced hydrogen and higher aromatic contents and resultant higher liner temperatures, and attention is given to lean burning, improved fuel atomization, higher freezing-point fuel, and deriving jet fuel from shale oil or coal. Noise sources including the fan, turbine, combustion process, and flow over internal struts, and attenuation using acoustic treatment, are discussed, while near-term reduction of polluting gaseous emissions at both low and high power, and far-term defining of the minimum gaseous-pollutant levels possible from turbine engines are also under study. J.P.B.

A80-17743 The scope of environmental risk management. T. O'Riordan (East Anglia, University, Norwich, England). *Ambio*, vol. 8, no. 6, 1979, p. 260-264. 17 refs.

Environmental risk management, which incorporates both scientific analysis and political judgement in a search for the safest route between social benefits and losses, is examined, and its role in decision-making institutions is discussed. Environmental risk management is shown to consist of the sequential functions of risk identification, risk estimation, risk evaluation and implementation, or risk control. The advances of environmental impact analysis and risk analysis are related to the adversary and consensus styles of political policymaking, and an organizational structure which would allow a combination of policy review and project assessment in a nonadversary seminar setting is proposed for the UK. It is concluded that the maturation of environmental risk management will not be seen until both politicians and scientists broaden the scope of their decision making to deal with a wider variety of interests. A.L.W.

A80-17751 Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volumes 1, 2 & 3. Conference sponsored by the International Atomic Energy Agency. Vienna, International Atomic Energy Agency (*Nuclear Fusion*, Supplement), 1979. Vol. 1, 846 p.; vol. 2, 690 p.; vol. 3, 566 p. Price of three volumes, \$238.

The volumes deal with the following: tokamak experiments and theory; high-beta systems, nonaxisymmetric systems, and plasma heating; and inertial confinement, and technical and reactor concepts. Specific topics covered include: investigations of lower-hybrid plasma heating in FT-1 tokamaks, deuterium diffusion studies in a tokamak plasma by pulsed injection, recent developments in linear theta-pinch and laser heated solenoid, stochastic ion heating by an electrostatic wave in a sheared magnetic field, as well as recent progress in inertial confinement fusion research at the Los Alamos Scientific Laboratory. C.F.W.

A80-17754 Results from the Divertor Injection Tokamak Experiment /DITE/. K. B. Axon, G. A. Baxter, J. Burt, W. H. M. Clark, G. M. McCracken, S. J. Fielding, R. D. Gill, D. H. J. Goodall, M. Hobby, and J. Hugill (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 51-64; Discussion, p. 64. 17 refs.

The paper contains a review of results obtained on the DITE experiment over the last two years and previously unpublished data on plasma stability, energy and particle transport, and hydrogen re-cycling. The new 1.2-MW neutral-injection system is described, with preliminary results of injection experiments into a 150-kA discharge. (Author)

A80-17759 Accumulation of impurities and stability behaviour in the high-density regime of Pulsator. W. Engelhardt, O. Klüber, D. Meisel, H. Murmann, S. Sesnic, G. Fussmann, E. Glock, N. Gottardi, F. Karger, and G. Lisitano (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 123-133; Discussion, p. 133, 134.

At the end of high-density plateaus a strong accumulation of impurities by a factor of 5 within less than 10 ms is observed in Pulsator. This leads to a displacement of the current into an outer region with a subsequent steepening of the gradient at the $q = 2$ surface. The resulting disruption prevents the production of longer density plateaus. From observations of the internal disruption and of the $m = 2$, $n = 1$ mode activity, it was determined that steep current gradients at $q = 2$ trigger the current disruption. The existence of a sharp density limit, however, cannot be explained satisfactorily in these terms. B.J.

A80-17789 High-beta tokamaks. R. A. Dory, D. P. Berger, L. A. Charlton, J. T. Hogan, J. K. Munro, D. B. Nelson, Y.-K. M. Peng, D. J. Sigmar, and D. J. Strickler (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 579-591; Discussion, p. 591, 592. 23 refs. Contract No. W-7405-eng-26.

MHD equilibrium, stability, and transport calculations are made to study the accessibility and behaviour of 'high-beta' tokamak plasmas in the range of about 5-15%. For next-generation devices, beta values of, at least, 8% appear to be accessible and stable if there is a conducting surface nearby. (Author)

A80-17790 Dependence of ideal MHD beta limits on current density and pressure profiles. R. Gruber, R. Schreiber, F. Troyon (Lausanne, Ecole Polytechnique Fédérale, Lausanne, Switzerland), W. Kerner, K. Lackner (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany), A. Sykes, and J. A. Wesson (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abington, Oxon, England). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 593-603; Discussion, p. 603. 5 refs.

Numerical calculations of the MHD stability of a range of JET equilibria have been made. It is found that by shaping the current profile stability can be obtained for low mode numbers for values of beta in excess of 10 percent provided the plasma surface is bounded by a conducting wall. In the absence of such a wall, all of the equilibria studied are found to be unstable to free boundary modes. (Author)

A80-17797 MHD stability limits on high-beta tokamaks. M. S. Chance, R. L. Dewar, E. A. Frieman, A. H. Glasser, J. M. Greene, R. C. Grimm, S. C. Jardin, J. Manickam, M. Okabayashi (Princeton University, Princeton, N.J.), and J. L. Johnson. In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 677-686; Discussion, p. 686, 687. 13 refs. Contract No. EY-76-C-02-3073.

Limitations on high-beta tokamaks are imposed by a number of ideal and resistive MHD instabilities. The present paper reports results on three such studies: (1) Numerical analyses using the Princeton PEST code on beta optimization of tokamaks for low toroidal mode numbers n ; (2) analytic and numerical results on ideal ballooning modes with high n ; and (3) analytic and numerical results on resistive modes at high n . (Author)

A80-17807 What is the mechanism responsible for the precursors of internal disruptions. A. Rogister and G. Hasselberg (EURATOM and Kernforschungsanlage Jülich GmbH, Institut für Plasmaphysik, Jülich, West Germany). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 1. Vienna, International Atomic Energy Agency, 1979, p. 809-813. 8 refs.

The theory of the resistive layer of the $m = 1$ (MHD marginally stable) mode is revisited by including a finite diamagnetic drift frequency. The equations describing the tearing mode are approximations of more general equations which admit another solution, i.e., the electromagnetic drift wave. For the $m = 1$ MHD neutral mode there is no instability of the drift-tearing type, i.e., with frequency of the resistive layer approximately equal to the electron diamagnetic drift frequency while the growth rate of the tearing mode is reduced. The electromagnetic drift wave is also found to be stable; this mode would, however, yield, like the tearing mode, a natural explanation for the formation of magnetic islands. It is concluded that the precursors of the internal disruption cannot be explained without taking toroidal effects into account. (Author)

A80-17809 LASL toroidal reversed-field pinch programme. D. A. Baker, C. J. Buchenauer, L. C. Burkhardt, J. N. DiMarco, J. N. Downing, A. Haberstick, R. B. Howell, A. R. Jacobson, H. J. Karr (California, University, Los Alamos, N. Mex.), and C. K. Chu (California, University, Los Alamos, N. Mex.; Columbia University, New York, N.Y.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 3-22. 15 refs. Research sponsored by the U.S. Department of Energy.

The determination of the absolute energy loss due to radiation from impurities in the LASL toroidal reversed-field pinch experiment ZT-S is reported. The measurements show that over half the energy loss is accounted for by this mechanism. Thomson-scattering electron density measurements indicate only a gradual increase in temperature as the filling pressure is reduced, indicating an increased energy loss at lower pressures. Cylindrical and toroidal simulations of the experiment indicate either that a highly radiative pinch boundary or anomalous transport is needed to match the experimental results. New effects on the equilibrium due to plasma flows induced by the toroidal geometry are predicted by the toroidal simulations. The preliminary results on the low-temperature discharge cleaning of the ZT-S torus are reported. A description of the upgrade of the ZT-S experiment and the objectives, construction and theoretical predictions for the new ZT-40 experiment are given. (Author)

A80-17811 Studies on plasma formation, relaxation and heating in a reversed-field pinch. M. Bagatin, A. Buffa, R. De Angelis, G. Malesani, and S. Ortolani (EURATOM and Consiglio Nazionale delle Ricerche, Centro di Studio sui Gas Ionizzati, Padua, Italy). In: Plasma physics and controlled nuclear fusion research 1978; Proceed-

ings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 37-52. 15 refs.

Some problems relevant for the formation, relaxation and heating of a comparatively slow pinch have been investigated. The spontaneous relaxation of the pinch to a reversed-field pinch (RFP) configuration has been studied under various conditions of the ratio of the current risetime ($\tau_{sub I}$) to the MHD time ($\tau_{sub A}$). For large $\tau_{sub I}/\tau_{sub A}$ the tendency of the pinch to evolve along a universal patch is more evident; the stability analysis and the axial flux amplification phenomenon are discussed. Ionization and start-up problems are shown to be important with reference to experiments performed on ETA-BETA I with long (exceeding 160 microsec) current risetimes and to zero-dimensional calculations of the ionization and formation phases. The steady-state and time-dependent power balance of the pinch is studied, with reference to a proposed RFP reactor, including impurity line radiation losses. Conditions for ignition are briefly discussed. (Author)

A80-17822 Principles of plasma heating and confinement in a compact toroidal configuration. A. G. Es'kov, R. Kh. Kurtmul'laev, A. P. Kreshchuk, Ia. N. Laukhin, A. I. Maliutin, A. I. Markin, Iu. S. Martiushov, B. N. Mironov, M. M. Orlov, and A. P. Proshletsov (Akademiia Nauk SSSR, Institut Atomnoi Energii, Moscow, USSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 187-204. 6 refs.

Data obtained on a so-called compact toroid (a configuration where shock compression improves the stable confinement properties) are generalized and shown to be valid in a magnetic field range of 2-12 kG, a plasma density range of 10 to the 14 to 10 to the 16th per cu cm, and chamber dimensions of 20-40 cm x 100-200 cm. Attention is given to the following aspects of the problem: pulsed shaping of closed structures; optimization of shock heating; methods of magnetic-structure shaping; stability of the neutral layer; shock wave characteristics and generation conditions; toroid injection; and principles of compact-toroid confinement. (Author)

A80-17824 End plugging of a hot linear theta pinch. H. Azodi, M. Naraghi, H. Tahsiri, and A. Torabi-Fard (Atomic Energy Organization of Iran, Fusion Div., Teheran, Iran). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 217-227. 6 refs.

With and without solid end plugging schemes, some plasma parameters and stability traits of a 1-m-long, 10-cm-coil-bore linear theta pinch which incorporates modular construction have been investigated. The compressed thermonuclear-like plasma, having maximum density of 10 to the 16th per cu cm and ion temperature exceeding 1 keV, is stable for a short life of 5-6 microsec. Numerical calculations treated in the sharp-boundary, two-fluid approximation, with the plug assumed to be held at a constant temperature and experiencing no ablation, have shown increases in $T_{sub e}$, $T_{sub i}$, and $N_{sub N}$, the rate of neutron production, when the end is plugged compared to the unplugged case. Streak photography at the midplane has shown a more stable but less compressed plasma when end plugs are used. Measurements of the extent of damage incurred by the plugs have shown that a similar amount of loss of plug material occurs whether the plugs are placed at the ends of the coil or positioned 20 cm outside the coil. (Author)

A80-17825 Recent developments in linear theta-pinch and laser-heated solenoid research. K. F. McKenna, R. R. Bartsch, R. J. Commisso, C. A. Ekdahl, K. B. Freese, R. F. Gribble, F. C. Jahoda, G. Miller, R. E. Siemon, and J. U. Brackbill (California, University, Los Alamos, N. Mex.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2.

Vienna, International Atomic Energy Agency, 1979, p. 229-246; Discussion, p. 246, 247. 25 refs. Research sponsored by the U.S. Department of Energy.

Efforts of groups at the Los Alamos Scientific Laboratory (LASL), Mathematical Sciences Northwest (MSNW), and the University of Washington (UW), are reported. Experiments on the LASL high energy Scylla IV-P theta pinch have been directed toward the investigation of particle and thermal losses, the plasma flow and magnetic field interaction processes near the coil ends, end-loss suppression using solid material and plugs, and the plasma stability characteristics. Theoretical efforts at LASL have dealt with the driving mechanisms of the observed $m = 1$ wobble instability, numerical studies of particle end-loss, instability effects on radial diffusion, and magnetoacoustic heating methods. The interaction of CO₂ laser radiation with theta-pinch-like plasma columns is being studied at MSNW and UW. In these experiments channeling of the laser light along the axis of a partially ionized plasma column and the resultant heating are investigated. (Author)

A80-17826 Heating, confinement and fluctuations in the CLEO stellarator. D. W. Atkinson, J. E. Bradley, A. N. Dellis, P. C. Johnson, D. J. Lees, P. J. Lomas, W. Millar, A. C. Selden, L. E. Sharp, and P. A. Shatford (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 251-263; Discussion, p. 263, 264. 9 refs.

The confinement of an Ohmically heated plasma has been investigated in the CLEO stellarator. The electron energy replacement time is found to decrease as the drift parameter, characterized by the ratio of electron drift velocity to electron thermal velocity, is increased. Density fluctuations have been seen but do not appear to explain the observed loss as being due to a drift instability. A beam of neutrals has been injected into a plasma produced by Ohmic heating: ion heating has been observed. The results have been compared with theoretical models. It is shown that increased power input will be necessary to sustain a currentless plasma of the same parameters as those produced by Ohmic heating. (Author)

A80-17829 Current equilibrium and effective ion charge in L-2 stellarator plasma. D. K. Akulina, E. D. Andriukhina, G. S. Voronov, M. S. Berezhetskii, S. E. Grebenshchikov, I. S. Danilkin, B. I. Kornev, O. I. Fedianin, I. S. Sbitnikova, and Iu. V. Khol'nov (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow, USSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 287-301. 6 refs.

This paper presents data on the equilibrium of a current in a stellarator magnetic field. It is shown that the equilibrium of a plasma column is only determined by the vacuum rotational transform angle at constant longitudinal and external transverse fields. The transverse field of the current is identical with the external transverse field. An investigation of the plasma radiation at a frequency of 2 Omega (Be) was carried out. It is shown that at a plasma density of greater than 7×10 to the 12th per cu cm the electron temperature obtained from the intensity of the cyclotron radiation is in a good agreement with the results of X-ray measurements and the radial temperature distribution is near to parabolic. Measurement of the effective ion charge in the plasma shows a discrepancy between the values obtained from plasma conductivity and those obtained from radiation in the soft-X-ray and visible regions of the spectrum. (Author)

A80-17840 Transverse particle losses in axially asymmetrical open traps. M. E. Kishinevskii, P. B. Lysianskii, D. D. Riutov, G. V. Stupakov, B. M. Fomel', B. V. Chirikov, and G. I. Shul'zhenko (Akademiia Nauk SSSR, Institut Iadernoi Fiziki, Novosibirsk,

USSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 411-426; Discussion, p. 426. 11 refs.

The effect of axial asymmetry of the magnetic field on transverse plasma losses from traps with improved longitudinal confinement is discussed. The role of these losses is characterized by the angle of rotation of the guiding centre of the particle around the magnetic axis during motion of the particle from mirror to mirror. The transport regimes are classified as a function of this angle. Corresponding analytical estimates of the transport coefficients are presented. A stochastic instability leading to collisionless diffusion due to field perturbation as a result of slight misalignments in the magnetic system was studied experimentally in terms of a specially constructed electron model in which the electrons moved in longitudinal magnetic and radial electric fields. Resonance and stochastic diffusion were also investigated numerically in terms of a special model. The numerical results are in satisfactory agreement with simple analytical estimates for the instability boundary and diffusion rate under the joint effects of resonances and multiple scattering. (Author)

A80-17846 Drift wave stability and transport theory in fusion systems. N. A. Krall, S. Hamasaki, J. B. McBride (Science Applications, Inc., La Jolla, Calif.), N. T. Gladd, P. H. Ng, H. H. Chen (Maryland, University, College Park, Md.), J. D. Huba (U.S. Navy, Naval Research Laboratory, Washington, D.C.), R. C. Davidson (U.S. Department of Energy, Washington, D.C.), R. E. Aamodt, and Y.-C. Lee (Science Applications, Inc., Boulder, Colo.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 483-495; Discussion, p. 495, 496. 17 refs.

The linear properties of lower hybrid, drift cyclotron, and drift cyclotron loss-cone instabilities are calculated including shear, beta and distribution function effects. Transport runs including these effects are carried out for experiment-sized and reactor-sized devices. Non-linear effects on the DC mode due to frequency and wavenumber shifts are calculated. (Author)

A80-17855 Fast-magnetosonic-wave excitation in large-tokamak plasmas. A. V. Longinov, K. N. Stepanov, V. A. Tsurikov (Akademiia Nauk Ukrainskoi SSR, Fiziko-Tekhnicheskii Institut, Kharkov, Ukrainian SSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 583-605; Discussion, p. 605. 16 refs.

A general description of fast magnetosonic wave (FMSW) excitation in a large plasma torus is given. Resonant excitation of a separate eigenmode is shown to be possible in a region of weak damping as well as resonant excitation of paired eigenmodes. With increasing damping multimode resonances appear and a regime of radiation into half space is realized in the strong damping region. Characteristics of FMSW excitation by a current layer in the presence of a metal screen (vacuum chamber) are discussed. Results are presented on the calculation of excitation and damping of FMSW with a frequency of $2\Omega_{Bi}$ in a T-10 tokamak. Attention is also given to the advantages and disadvantages of using different regimes of FMSW excitation for plasma heating in tokamaks of various dimensions. B.J.

A80-17857 Investigation of plasma heating by powerful relativistic electron beams. A. V. Arzhannikov, A. V. Burdakov, B. N. Breizman, A. S. Burmasov, L. N. Viacheslavov, V. S. Koidan, V. V. Koniukhov, V. A. Kornilov, E. P. Krugliakov, and V. N. Lukh'ianov (Akademiia Nauk SSSR, Institut Iadnoi Fiziki, Novosibirsk, USSR). In: Plasma physics and controlled nuclear fusion research

1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 2. Vienna, International Atomic Energy Agency, 1979, p. 623-637; Discussion, p. 637. 10 refs.

Plasma heating experiments using relativistic electron beams (part of a solenoid-based thermonuclear program) were carried out on the GOL-1 and INAR devices. Transport of a beam with current up to 55 kA in a multimirror magnetic field was obtained on the GOL-1 device without any indication of development of macroscopic instabilities. INAR experiments showed an increase in magnetic field up to 25 kOe and a decrease in the anode foil thickness down to 6 microns, making it possible to achieve 20% efficiency of energy transfer from the REB with a current density of 1 kA/sq cm to a plasma with a density of 4×10^{14} per cu cm at a plasma column length of 240 cm. B.J.

A80-17860 The KMSF laser fusion programme. R. L. Berger, P. M. Campbell, G. Charatis, J. G. Downward, T. M. Henderson, R. R. Johnson, T. A. Leonard, F. J. Mayer, D. Mitrovich, and N. K. Moncur (KMS Fusion, Inc., Ann Arbor, Mich.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 3-15. Contract No. ES-77-C-02-4149.

Laser-driven implosion experiments have been performed at both 1.06 microns and 0.53 microns. The fractional absorption was greater at 0.53 microns although with the laser power available at 0.53 microns it was not possible to observe effects of a high-temperature corona. Other experiments were performed using cryogenic targets at 1.06 microns. It was found that the neutron yield and peak fuel densities were greater when the fuel formed a liquid or solid layer on the inside of the spherical glass-shell targets. (Author)

A80-17861 Inertial confinement fusion at NRL. S. E. Bodner, J. P. Boris, G. Cooperstein, S. A. Goldstein (U.S. Navy, Naval Research Laboratory, Washington, D.C.; Science Applications, Inc., McLean, Va.), D. Mosher, B. H. Ripin, R. Decoste (U.S. Navy, Naval Research Laboratory, Washington, D.C.; Maryland, University, College Park, Md.), J. H. Gardner, R. Lee, and R. H. Lehmberg (U.S. Navy, Naval Research Laboratory, Washington, D.C.; Jaycor, Inc., McLean, Va.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 17-28. 27 refs. Research supported by the U.S. Department of Energy.

The NRL Inertial Confinement Fusion Program's emphasis has moved toward pellet concepts which use longer (10 ns) lower intensity driver pulses than previously assumed. For laser drivers, this change was motivated by recent experiments at NRL with enhanced stimulated Brillouin backscatter. For ion drivers, the motivation is the possibility that substantial energy at 10-ns pulse lengths may soon be available. To accept these 10-ns pulses, it may be necessary to consider pellets of larger radius and thinner shell. The computational studies of Rayleigh-Taylor instability at NRL indicate the possibility of a dynamic stabilization of these thinner shells. (Author)

A80-17862 Recent progress in inertial confinement fusion research at the Los Alamos Scientific Laboratory. R. B. Perkins (California, University, Los Alamos, N. Mex.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 41-52; Discussion, p. 52. 13 refs. Research sponsored by the U.S. Department of Energy.

Recent progress in the inertial confinement fusion programme at the Los Alamos Scientific Laboratory is reviewed. Helios, an eight-beam 10-kJ CO₂ laser, became operational in April 1978 and

has produced output powers exceeding 21 TW. Antares, a 100-kJ CO₂ laser, is under construction and should permit breakeven experiments in 1983/84. Current and planned target experiments are discussed. Laser fusion power plants employing CO₂ lasers are being studied to identify areas requiring early attention. (Author)

A80-17863 Work on laser interaction and implosion at Centre d'Etudes de Limeil. A. Bekiarian, E. Buresi, A. Coudeville, R. Dautray, F. Delobbeau, P. Guillauneux, C. Patou, J. M. Reisse, B. Sitt, and J. M. Vedel (Commissariat à l'Energie Atomique, Centre d'Etudes de Limeil, Villeneuve-Saint-Georges, Val-de-Marne, France). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 65-72; Discussion, p. 72,73. 15 refs.

A80-17864 Experimental studies of interaction and transport processes in laser fusion. A. Amiranoff, R. Benattar, R. Fabbro, E. Fabre, C. Garban, C. Popovics, A. Poquerusse, C. Stenz, J. Virmont (Ecole Polytechnique, Palaiseau, Essonne, France), and R. Sigel. In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 75-85. 6 refs.

The effect of laser wavelength and pulse shaping on interaction and the transport process is investigated. Experiments show that absorption increases with shorter wavelength, from 35% at 1.06 microns to 45% at 0.53 microns. The production of hot electrons is significantly reduced in short-wavelength experiments. The hot electron temperature determined from X-ray emission decreases from 8 keV at 1.06 microns wavelength to 2 keV at 0.53 microns, indicating a better thermal electron transport at shorter wavelength. The measurement of burn-through depth has confirmed this result, showing that at 0.53 microns this depth is almost three times larger than at 1.06 microns. Experiments with different types of prepulse show that there is a difference between discrete and continuous prepulse in backscattering and refraction effects, in favour of the continuous pulse shaping. It is also observed that pulse shaping enhances lateral thermal transport. (Author)

A80-17867 Developments in Sandia Laboratories particle beam fusion programme. G. Yonas (Sandia Laboratories, Albuquerque, N. Mex.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 125-132; Discussion, p. 132, 133. 21 refs. Research supported by the U.S. Department of Energy.

Recent developments in the fields of reactor design, target concepts and electron and light ion driver development in Sandia Laboratories' particle beam fusion program are reviewed. Requirements for a reactor in which several megavolt megampere electron or ion beams propagate within multiple magnetized plasma channels are discussed, and results of experiments with a target containing preheated fuel and magnetic fields for electron thermal conduction suppression are presented, noting observed deposition enhancement and the coupled nature of electron focusing and deposition. Investigations of high-current-density electron and light ion drivers are outlined, and the use of multiple, compact pulse-forming modules in the 50-kJ range to achieve the multimegajoule beam levels required in both approaches is discussed. A.L.W.

A80-17868 Inertial confinement fusion research at Osaka. H. Azechi, H. Fujita, K. Imasaki, Y. Izawa, Y. Kato, Y. Kawamura, M. Matoba, K. Mima, S. Miyamoto, and Y. Mizumoto (Osaka University, Osaka, Japan). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 135-154; Discussion, p. 154. 7 refs.

A80-17869 Laser fusion implications of resonance absorption and associated electrostatic field pressure. T. P. Donaldson, J. E. Balmer, P. Wägli, and P. Lädach (Bern, Universität, Berne, Switzerland). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 157-165. 31 refs.

Resonance absorption of laser radiation in plasma and some of its implications for laser fusion have been studied. The angular width of the resonance is shown to be broad enough to permit a non-critical incidence angle, which is important when laser radiation is focused onto the curved surface of a microsphere. For the range of parameters studied, the energy loss to non-thermal ions is found to be small. Modification of the electron density profile by the resonant electrostatic field pressure is shown to play an important role. (Author)

A80-17870 Non-linear theory of collective processes in laser-pellet interaction and soliton generation. H. H. Chen, C. Grebogi, C. S. Liu, and V. K. Tripathi (Maryland, University, College Park, Md.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 181-186. 20 refs.

The paper proposes soliton generation through the ponderomotive force effect of large amplitude electrostatic waves generated locally around the resonance region as a saturation mechanism for collective processes in laser-pellet interaction. Collective processes involving the interaction of plasma and ion waves with laser waves affect the absorption and scattering of laser light and determine the efficiency of laser-pellet coupling. As a result of wave growth in a localized region, ponderomotive force tends to push the plasma out of the high intensity region, leading to the formation of soliton and density cavity. The local reduction of plasma density gives rise to a nonlinear frequency shift of the plasma wave, and it modifies the density profile affecting the growth of subsequent parametric instability. The roles of soliton formation in the resonance absorption at critical density, parametric decay into two plasmons, and Raman backscattering at quarter-critical density are discussed. A.T.

A80-17871 Wave absorption and superreflectivity of laser plasmas due to electromagnetic structure resonances. K. Sauer, K. Baumgärtel (Deutsche Akademie der Wissenschaften, Zentralinstitut für Elektronenphysik, Berlin, East Germany), and N. E. Andreev (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow, USSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 187-199. 8 refs.

The interaction of normally incident electromagnetic waves of high intensity with an inhomogeneous plasma whose maximum density is above the critical one is investigated theoretically. Structure resonances can be formed self-consistently due to deformations of the plasma density profile which are produced by the ponderomotive force. During the resonance, the electromagnetic energy is temporarily trapped in a self-induced density cavity whereby the reflection coefficient decreases to values near zero. Simultaneously, the absorption coefficient reaches a maximum of about 50%. The rest of the energy is re-emitted when the resonance is destroyed. In this moment, peak values of the reflection coefficient greater than one can occur. The characteristic properties of these structure resonances have been studied analytically using a linear model in which the resonant density cavity is approximated by a step-like density profile (caviton model). (Author)

A80-17872 Theory of cavitons in laser-irradiated plasmas. K. H. Spatschek, M. Y. Yu, and P. K. Shukla (Bochum, Ruhr-Universität, Bochum, West Germany). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh

International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 201-208.

The propagation and absorption of laser light at the outer region of the corona as well as at critical density are crucially dependent on the density profile. For large intensities the density profile varies self-consistently through the radiation pressure and other nonlinear effects such as relativistic electron-mass variations. The paper deals with calculating the plasma density cavitation in different regions which can occur in laser fusion experiments. Two pertinent problems are considered: (1) density depression caused by mode-converted Langmuir waves in the critical region; and (2) density localization caused by the radiation pressure of very-high-power laser light. The results of large-scale density steepening are discussed. A new phenomenon of supersonic density humps is discovered. S.D.

A80-17873 The United States programme in heavy ion beam fusion. T. F. Godlove and D. F. Sutter (U.S. Department of Energy, Washington, D.C.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 211-222; Discussion, p. 222, 223. 12 refs.

Inertial confinement fusion relies on the rapid delivery of a large pulse of energy to a small heavy hydrogen mass, resulting in its compression and burn during a brief period of inertial confinement. Means that have been identified as promising for delivery of the required energy are lasers, electrons, light ions and, most recently, heavy ions. Although the requirements in terms of energy and power are similar for all delivery methods, the origin of the technology, the scientific and technical issues, and the projected characteristics of each method are quite different. Heavy ion fusion as a distinct programme in the USA has been funded since early 1977. In this paper the pellet requirements and potential advantages of the method are described, followed by a discussion of the various scientific and technical aspects of accelerator design and beam transport which are being studied so that a more complete evaluation can be made together with other pellet drivers in the mid-1980s.

(Author)

A80-17874 Nuclear fusion by cylindrical ion implosion. M. Gryzinski, J. Appelt, J. Baranowski, M. Bielik, E. Gorski, A. Horodenski, L. Jakubowski, A. Jerzykiewicz, J. Kurzyrna, and J. Langner (Instytut Badan Jadrowych, Swierk, Poland). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 225-236. 11 refs.

The present status of investigations on ion-implosion fusion undertaken at the Institute of Nuclear Research, Swierk, Poland, in the early 1960s is presented. Since then several experiments on production of intense radially convergent ion beams have been carried out by means of cylindrical devices equipped with coaxial electrodes consisting of thin metal rods, placed symmetrically and parallel to the axis of symmetry. With these devices, supplied from condenser banks of energy 10 - 20 kJ operated at 30 kV initial voltage, deuteron beams have been produced in a few hundred nanosecond pulses with energy sometimes greater than 30 keV and intensity of the order of 10 kA. The production of energetic ions was accompanied by the production of neutrons, up to 5 times ten to the 8th n per discharge. It was found from X-ray observations that convergent ion beams are focused on the symmetry axis of the system so that the cross-section of the dense plasma is several millimetres in diameter. Investigations on a complete symmetric implosion by means of a 150-kJ device have begun. (Author)

A80-17875 Calculations of inertial confinement fusion gains using a collective model for reheat, bremsstrahlung and fuel depletion for highly efficient electrodynamic laser compressions. H. Hora, R. Castillo, R. G. Clark, E. L. Kane, V. F. Lawrence, R. D. C. Miller, M. F. Nicholson-Florence, M. M. Novak, P. S. Ray, and J. R. Shepanski (New South Wales, University, Kensington, Australia). In:

Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 237-245. 47 refs.

A80-17876 Low-aspect-ratio limit of the toroidal reactor - The spheromak. M. N. Bussac, M. N. Rosenbluth (Institute for Advanced Study, Princeton, N.J.), H. P. Furth, M. Okabayashi, and A. M. M. Todd (Princeton University, Princeton, N.J.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 249-264; Discussion, p. 264. 24 refs. Contracts No. EY-76-C-02-3073; No. E(11-1)-3237.

The ideal and resistive MHD stability properties of a class of toroidal plasma configurations ('spheromaks') having internal toroidal and poloidal fields and external poloidal fields are considered. The reactor advantage of the spheromak is two-fold: (1) the maximum field strength at the external coils is about half the field at the plasma centre, rather than twice, as in a tokamak, and (2) a roughly spherical blanket can be used, rather than a blanket that links the plasma topologically. Taylor's criterion, which ensures stability against both ideal and resistive modes, has been applied to force-free spheromaks of unity aspect ratio. In the presence of a loosely fitting external conducting shell, oblate spheromaks are stable against all modes except short-wave surface kinks (which are an artifact of the idealized current density profile). The Mercier criterion gives a beta-limit below 1%; however, at aspect ratio greater than or almost equal to 1, the beta-limit for representative spheromak models rises into the range 2-4%. (Author)

A80-17877 Boundary layer analysis of cold-blanket systems. B. Lehnert, B. Bonnevier, J. R. Drake, A. Kuthy, D. Ohlsson, E. Tennfors, and B. Wilner (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 265-275; Discussion, p. 275, 276.

Theoretical analysis of the partially ionized boundary layer of a magnetized plasma indicates that a cold-blanket state exists only within restricted ranges of such parameters as the power input, the ion density, and the beta-value. In tokamaks, cold-blanket operation is likely to require total beta-values of at least a few per cent. Experimental investigations show that the plasma core density increases with the imposed power input, as long as the plasma is permeable to neutral gas. On the other hand, at large enough power inputs and ion densities to sustain in impermeable plasma, the core density becomes weakly dependent on both the power input and the neutral wall density, while the boundary layer thickness then decreases as the power input increases. (Author)

A80-17883 The Elmo Bumpy Torus /EBT/ reactor. N. A. Uckan, D. B. Batchelor, E. S. Bettis, R. A. Dandl, C. L. Hedrick, E. F. Jaeger, D. B. Nelson, L. W. Owen, R. T. Santoro (Oak Ridge National Laboratory, Oak Ridge, Tenn.), and D. G. McAlees (Oak Ridge National Laboratory, Oak Ridge, Tenn.; Exxon Nuclear Co., Inc., Bellevue, Wash.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3. Vienna, International Atomic Energy Agency, 1979, p. 343-356. 21 refs. Contract No. W-7405-eng-26.

The EBT combines many of the most attractive features of both tokamaks and mirrors into an attractive reactor configuration: steady-state operation, potential for high beta, large aspect ratio, modular construction, favorable geometry for ease of maintenance, modest technology requirements, high Q value, and economic potential. Recent designs which incorporate the increased understanding from plasma research have lead to smaller reactors with easier and practical maintenance. Critical physics issues are discussed, and dimensionless parameter scalings are explored. S.D.

A80-17884 Impact of technology and maintainability on economic aspects of tokamak power plants. M. A. Abdou, C. C. Baker, J. Brooks, R. Clemmer, C. Dennis, D. Ehst, K. Evans, S. Harkness, R. Kustom, and V. Maroni (Argonne National Laboratory, Argonne, Ill.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 357-367; Discussion, p. 367, 368. 7 refs.

Results of system studies on the primary energy conversion, energy storage and transfer, tritium and vacuum subsystems of a tokamak reactor are presented. These results quantify technology choices and maintainability on the economics of tokamak power plants. It is found that the expensive refractory alloys must offer a factor of three or greater advantage in lifetime compared to stainless steel in order that their costly development should have a reasonable benefit-to-cost ratio. Five reactor concepts are analyzed in terms of their scheduled maintenance requirements for replacing the first wall and blanket. The total downtime is found to vary from approximately 100 days to 500 days for a single replacement of the entire first wall and blanket. Substantial reduction in the power supply requirements and costs over previous estimates seems possible. The emergency air detritiation system is found to be a major cost item.

(Author)

A80-17885 Concept of tokamak-type reactor with high-temperature blanket. N. N. Vasil'ev, V. E. Lukash, A. V. Nedospasov, L. B. Nefedkina, V. G. Petrov, M. Z. Tokor (Akademiia Nauk SSSR, Institut Vysokikh Temperatur, Moscow, USSR), B. N. Kolbasov, D. K. Kurbatov, V. V. Orlov, and V. I. Pistunovich (Akademiia Nauk SSSR, Institut Atomnoi Energii, Moscow, USSR). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 379-386; Discussion, p. 386, 387. 9 refs.

A design study for a tokamak reactor with a high-temperature blanket is presented. It is expected that such a reactor, whose structure is more complicated than that of a low-temperature one, may be used as a source of high-temperature heat as well as for, e.g. hydrogen production from water. Parameters of such a device are given.

(Author)

A80-17887 Tandem mirror reactors. B. G. Logan, W. L. Barr, D. J. Bender, G. A. Carlson, W. L. Dexter, J. N. Doggett, R. S. Devoto, T. K. Fowler, G. W. Hamilton (California University, Livermore, Calif.), and J. F. Fink. In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 401-410; Discussion, p. 410, 411. 14 refs. Contract No. W-7405-eng-48.

Preliminary designs of tandem mirror fusion reactors burning D-T fuel and of fusion-fission (hybrid) tandem mirrors producing both fissile fuel and electricity have been made. For the hybrid reactor, it is found that, by using stream-stabilized, 2XIIIB-like plugs and by injecting 200-keV deuterium beams into a tritium-plasma target confined electrostatically in the solenoid, a useful Q (fusion power/injection power) near unity is obtained. The D-T tandem reactor parameters are optimized to obtain the minimum capital cost per kW(e) net. To allow for more expensive injector costs, a higher D-T reactor Q of 10 is obtainable with increased power output or decreased neutron wall loading. Fokker-Planck calculations show steady-state Q of approximately 5 for D-D tandem reactors burning only deuterium fuel and its reaction products, with most of the charged-particle fusion power recovered in a direct converter.

(Author)

A80-17888 Fuel production characteristics of fusion hybrid reactors. R. P. Rose, T. C. Varljen (Westinghouse Electric Corp., Pittsburgh, Pa.), F. L. Ribe, N. J. McCormick, G. C. Vlases, G.

L. Woodruff (Washington, University, Seattle, Wash.), V. L. Teofilo, B. R. Leonard, Jr., D. T. Aase, and R. T. Perry (Battelle Pacific Northwest Laboratories, Richland, Wash.). In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 413-418; Discussion, p. 419. 9 refs. Research supported by the Electric Power Research Institute; Contracts No. EG-77-C-02-4544; No. EN-77-3-01-6173; No. EY-76-C-03-0167.

The potential role of hybrid systems in the production of fuel for fission reactors is examined in the context of a possible serious fuel shortfall developing early in the next century. Various proliferation-resistant fuel-cycle options are considered, including the use of the Th/U233 fuel cycle and the Refresh Concept. It is concluded that the fusion hybrid reactor has a high potential to extend fuel resources for nuclear power stations. The hybrid concept also appears to offer the flexibility to operate with a variety of fuel-cycle options. Furthermore, a demonstration of fissile-fuel production in a hybrid based on the tokamak concept appears to be a feasible near-term goal.

(Author)

A80-17893 Summary on inertial-confinement fusion. K. Nishikawa (Hiroshima, University, Hiroshima, Japan). (*Nuclear Fusion*, vol. 19, Jan. 1979, p. 137-142.) In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 469-478.

It is noted that great progress has been made in recent years, particularly in understanding laser plasma coupling and the implosion process with the aid of various diagnostic developments. The paper summarizes the problems relevant to this progress by classifying them into three topics: (1) driver technology, (2) driver plasma coupling, and (3) implosion and target design. Finally, attention is given to some problems which need further investigation. In conclusion, it is stressed that international collaboration is of paramount importance, and that the classification policy followed in some countries may be a hindrance to timely progress of research.

M.E.P.

A80-17894 Summary on reactor systems. R. W. Conn (Wisconsin, University, Madison, Wis.). (*Nuclear Fusion*, vol. 19, Jan. 1979, p. 143-146.) In: Plasma physics and controlled nuclear fusion research 1978; Proceedings of the Seventh International Conference, Innsbruck, Austria, August 23-30, 1978. Volume 3.

Vienna, International Atomic Energy Agency, 1979, p. 479-485.

The papers at the Innsbruck Conference on reactor systems and technology dealt primarily with reactor design and plasma engineering. The present review covers four categories of reactor systems - tokamaks, magnetic confinement, nontokamaks, and inertial confinement. Some special topics, such as plasma engineering and alternate applications of fusion, are examined.

V.P.

A80-18086 The effect of current shear on the tearing instability. R. J. Barker and O. Buneman (Stanford University, Stanford, Calif.). *Journal of Plasma Physics*, vol. 22, Dec. 1979, p. 453-476. 20 refs. NSF Grant No. ENG-76-02402.

A fully relativistic stream superposition model is employed to conduct a linear numerical simulation of a self-consistently confined sheet of collisionless, neutral plasma. This multi-stream model employs a novel variable termed the 'canonical momentum potential' (or 'action function') to follow the ion and electron dynamics. For the classic, unshredded sheet pinch, growth rates obtained for the tearing instability are in reasonable agreement with previous estimates using an approximate Vlasov approach. Current shear is then introduced into the sheet and growth rates are again measured. Stabilization of the shorter wavelength modes is observed. (Author)

A80-18110 X-ray measurement of laser fusion targets using least squares fitting. R. M. Singleton, B. W. Weinstein, and C. D. Hendricks (California, University, Livermore, Calif.). *Applied Optics*, vol. 18, Dec. 15, 1979, p. 4116-4123. 10 refs. Contract No. W-7405-eng-48.

The paper presents an X-ray technique for measurement of opaque hollow microspheres used as laser fusion targets. Consideration is given to a nondestructive method for holding microspheres that enables microsphere rotation between X-ray exposures. Film images of the microspheres are recorded using contact microradiography. Computer image analysis is used for measurement of the microsphere characteristics, which involves mathematically modeling processes that relate the microsphere characteristics to film density and then applying a least squares fit of the model to the image data. This measurement is compared with the optical interferometric measurement for several glass microspheres and it is found that measurement differences are less than 0.3 micron for wall thickness and 0.1 micron for nonconcentricity. (Author)

A80-18111 Multichannel Thomson scattering system for the tokamak TFR based on two-detector spectrum analyzers. J. Lasalle and P. Platz (EURATOM and Commissariat à l'Energie Atomique sur la Fusion, Département de Physique du Plasma et de la Fusion Contrôlée, Fontenay-aux-Roses, Hauts-de-Seine, France). *Applied Optics*, vol. 18, Dec. 15, 1979, p. 4124-4133. 10 refs.

In actual and future large tokamaks, the electron temperature $T(e)$ and density $n(e)$ profiles must be measured with a single discharge and laser shot. To accomplish this, $T(e)$ is deduced from the ratio of powers scattered into two large spectra intervals, while $n(e)$ is deduced from the absolute power detected in one of the intervals and from the knowledge of $T(e)$. The spectrometers designed for this purpose and their calibration are described. $T(e)$, $n(e)$ profiles are obtained in a single shot on TFR with a nine-channel scattering system based on these two-detector spectrometers. (Author)

A80-18123 A method of estimating monthly average solar radiation on shaded receivers. D. M. Utzinger and S. A. Klein (Wisconsin, University, Madison, Wis.). *Solar Energy*, vol. 23, no. 5, 1979, p. 369-378. 9 refs. Research supported by the U.S. Department of Energy.

A80-18124 Analysis of systems for the generation of electricity from solar radiation. W. G. Pollard (Oak Ridge Associated Universities, Inc., Institute for Energy Analysis, Oak Ridge, Tenn.). *Solar Energy*, vol. 23, no. 5, 1979, p. 379-392. 8 refs.

An analysis relating the annual electrical output of any solar-electric facility directly to the effective annual insolation received on its solar collectors per unit collector area is presented. An expression for the capacity factor of such facility is derived through which the ratio of the actual annual electrical output to the maximum mean annual output without demand, generating and downtime reductions, and storage losses can be determined. Expressions are also derived for a solar availability factor which measures the ratio of the annual output of the solar facility to that of a fuel-fired plant. The capital cost of solar-electric facilities comprises cost of solar-electric generation, nonsolar auxiliary power, and storage, and the choice of solar collector area and of the relative dependence on storage and auxiliary nonsolar power are also discussed. A.T.

A80-18125 The impact of a conceptual solar thermal electric conversion plant on regional meteorological conditions - A numerical study. C. M. Bhumralkar, A. Slemmons (SRI International, Menlo Park, Calif.), and J. Williams (National Center for Atmospheric Research, Boulder, Colo.). *Solar Energy*, vol. 23, no. 5, 1979, p. 393-403. 8 refs. Research supported by the International Institute for Applied Systems Analysis and United Nations Environment Program.

A two-dimensional, mesoscale model of the atmosphere that incorporates hydrodynamic, thermodynamic, and microphysical

processes has been applied to simulate the impact on regional weather of a solar-thermal electric conversion (STEC) installation in southern Spain. The STEC plant is conceptualized to occupy an area of 1,000 sq km with heliostats covering 25 per cent of the total power plant area. It is assumed to use wet natural draft cooling towers for dissipating waste heat into the atmosphere. The 2-D model is applied to a STEC facility that covers a distance of 32 km in the horizontal with heliostats installed in the middle over a distance of 8 km. The model has been integrated for 9 hr of real time for both typical summer and winter conditions. The results of integration for summer indicate that a STEC installation of the above size has considerable potential for modifying regional weather. Clouds formed after 5 hr of real-time integration and persisted until the end of the integration; rainfall also occurred. In contrast, clouds did not form until 7 hr of real-time integration without the installation and were more sporadic and transient; rainfall was much less. The results for winter conditions do not show any cloud formation after 9 hr of real-time integration. This difference between summer and winter cases is attributed to the very strong winds used as initial conditions for the winter simulation. (Author)

A80-18126 Selective black nickel coatings on zinc surfaces by chemical conversion. P. K. Gogna and K. L. Chopra (Indian Institute of Technology, Delhi, India). *Solar Energy*, vol. 23, no. 5, 1979, p. 405-408. 11 refs.

A flat plate solar collector uses a selective coating to convert solar radiation into thermal energy that is transferred from the absorber to the working fluid. Spectral selectivity is possible because the solar spectrum and the spectral distribution of the thermal reradiation emitted from the coating are distinct, as illustrated elsewhere (Jurisson et al., 1975). An electrochemical conversion has been developed to deposit selective black nickel coatings of high absorptance-to-emittance ratio on galvanized iron as well as on zincated and zinc electroplated aluminum substrates. The paper reports on the microstructure and the optical and thermal properties of black nickel deposited on these zinc surfaces. The effect of various deposition parameters on the optical and thermal performance of the coatings is studied. Durability tests of thermal cycling, humidity tests and exposure to sunlight are carried out to evaluate the coatings. S.D.

A80-18127 High temperature solar collector with optimal concentration - Non-focusing Fresnel lens with secondary concentrator. M. Collares-Pereira (Chicago, University, Chicago, Ill.). *Solar Energy*, vol. 23, no. 5, 1979, p. 409-420. 24 refs. Research sponsored by the Instituto Nacional de Investigação Científica.

A80-18128 Sensitivity of direct gain space heating performance to fundamental parameter variations. W. O. Wray and J. D. Balcomb (California, University, Los Alamos, N. Mex.). *Solar Energy*, vol. 23, no. 5, 1979, p. 421-425. 7 refs. Research sponsored by the U.S. Department of Energy.

Interest in passive solar space heating has increased steadily over the past few years. Much of this interest has centered on direct gain structures because they depart the least from conventional construction and are therefore more acceptable to the market. Construction of direct gain houses has proceeded in spite of the lack of well-validated design guidelines capable of quantifying expected thermal performance. In an effort to provide such guidelines, a thermal network code based on PASOLE is being developed specifically for direct gain systems. This new code is called SUNSPOT and is designed to operate at two levels of detail, depending on the needs of the user. Specifically, a computer program has been developed for analyzing the performance of direct gain passive solar heated enclosures. This computer program is validated by comparison with data from passive solar test cells. The direct-gain enclosure characteristics revealed by a sensitivity study are identified as design guidelines applicable to any climate. S.D.

A80-18129 Photovoltaic solar cell array used for supplemental power generation. A. S. Barker, Jr. (Bell Telephone Laboratories, Inc., Whippany, N.J.) and H. J. Power (AT & T, New York, N.Y.). *Solar Energy*, vol. 23, no. 5, 1979, p. 427-434. 6 refs.

A study of the performance of a silicon cell non-tracking photovoltaic array has been made over a three year period. The array provided power in parallel with commercial utility power in a shared mode which makes use of all the solar energy generated. Tests of degradation, dirt accumulation, compatibility with telephone plant, and day by day performance were performed. A method is developed for predicting the energy output of a non-tracking array based on standard global insolation measurements. (Author)

A80-18130 Solar heating system performance estimation using sinusoidal inputs. M. S. Drew and R. B. G. Selva (S-Matrix Enterprises, Ltd., Richmond, British Columbia, Canada). *Solar Energy*, vol. 23, no. 5, 1979, p. 435-442. 14 refs. Research supported by the British Columbia Ministry of Education, Science and Technology.

A method is presented for the estimation of the fraction of the heating load supplied by solar energy during the heating season. This procedure remains useful even when system design parameters are far from the norm, and in particular is applicable to systems incorporating seasonal storage of heat. Insolation, temperature and hot water demand are input as sinusoids, and the closed-form solution of the heat transfer differential equation is found. The method as presented here is suitable for domestic hot water and liquid space heating systems. (Author)

A80-18131 An electrochemical heat engine for direct solar energy conversion. R. H. Hammond and W. M. Risen, Jr. (Brown University, Providence, R.I.). *Solar Energy*, vol. 23, no. 5, 1979, p. 443-449. Research supported by the Research Corp.

A system is described and tested which converts heat directly into electrical energy. It employs a solution electrochemical reaction with a small polarizability and a large molar entropy change. This is run in opposite directions in two cells: one at high temperature, where heat is absorbed, and one at low temperature, where heat is emitted. The difference in heat absorbed and heat emitted is available as electrical work; recirculation of the solutions between these cells gives a closed regenerative EMF system. The conversion efficiency of the system is high, varying from 50 to 75 per cent of the Carnot efficiency as the power output varies from maximum to 75 per cent of maximum. The power output depends strongly upon the reaction used. For the reaction tested here, the power output density was 6.4 W/sq m of cell area for operation between 90 and 30 C. Design factors for improving power output density and minimizing costs are discussed, and basic requirements for successful cell reactions are given. The feasibility of obtaining power output on the order of 200 W/sq m of cell area at 35 per cent conversion efficiency using 300 C input heat is discussed. (Author)

A80-18132 Performance and analysis of a 'series' heat pump-assisted solar heated residence in Madison, Wisconsin. R. E. Terrell (Wisconsin, University, Madison, Wis.). *Solar Energy*, vol. 23, no. 5, 1979, p. 451-453. 6 refs.

A80-18133 A simplified technique for comparing the effectiveness of collector absorber coatings. R. K. Collier (California, University, Los Alamos, N. Mex.). *Solar Energy*, vol. 23, no. 5, 1979, p. 455-458. Research sponsored by the U.S. Department of Energy.

It is noted that there has been some confusion about how to rate the performance of selective surface absorbers. Edwards et al. (1962) developed a concept called the 'absorptance of merit' for comparing selective surfaces. This concept was further developed to demonstrate the comparison of various surfaces for varying environmental conditions. The present paper is an attempt to take that previous work and formulate a universal graphical concept that requires a minimum of calculation for comparing the relative effectiveness of various selective surfaces. It is noted that while the best way to judge the relative effectiveness of various absorber coatings is to perform a yearly simulation of collector performance,

the scheme described is a simple and effective alternative. It is concluded that the advantage of this scheme is that the relative trade-offs are displayed visually for quick reference. M.E.P.

A80-18137 Influence of the loading factor on the performance characteristics of series MHD generators. G. P. Bazarov, E. N. Kufa, and S. A. Medin. (*Magnitnaia Gidrodinamika*, Apr.-June 1979, p. 99-104.) *Magnetohydrodynamics*, vol. 15, no. 2, Oct. 1979, p. 193-197. Translation.

Local and integral characteristics of singly loaded series MHD generators operating under partial loads are investigated. Two-dimensional channels with perfectly sectioned electrodes having different types of sectional connection are considered. The flow parameters and channel height are assumed to be constant, and the calculations are performed by the finite-difference technique. It is shown that in the region where the current-collecting electrodes join a sectioned part of the channel, a significant increase in electric-field density is possible when the load factor is changed. F.G.M.

A80-18138 Induced fields in the motion of a conducting medium in the field of an air-core magnetic system. A. M. Anisimov, V. F. Vasil'ev, I. V. Lavrent'ev, and V. L. Ovchinnikov. (*Magnitnaia Gidrodinamika*, Apr.-June 1979, p. 136, 137.) *Magnetohydrodynamics*, vol. 15, no. 2, Oct. 1979, p. 220, 221. Translation.

An equation is obtained which describes the distribution of the magnetic field induced in a conducting medium when that medium moves in the transverse field of an air-core magnetic system. It is shown that the channel height, rather than its width (as is the case for ferromagnetic systems), is the characteristic linear dimension involved in the magnetic-Reynolds-number determination. Experiments performed with electrically conducting films moving in the field of two Helmholtz coils are discussed which demonstrate that the experimental data are in completely satisfactory agreement with a computer-aided solution to the equation obtained. F.G.M.

A80-18139 Characteristics of series channels with a diminishing electrode-commutation angle in the transition section. G. P. Bazarov and E. N. Kufa. (*Magnitnaia Gidrodinamika*, Apr.-June 1979, p. 138-140.) *Magnetohydrodynamics*, vol. 15, no. 2, Oct. 1979, p. 222-224. Translation.

Local and integral characteristics of singly loaded series MHD generators with a reduced electrode commutation angle in the connecting section are investigated. Boundary-value problems for two-dimensional channels with constant flow properties and a magnetic field that varies along the channel are solved by the finite-difference method; the parameters of the solution are the position of the channel with respect to the magnetic field and the connecting-section geometry. It is shown that the integral characteristics of the generators considered are not degraded under rated operating conditions and that channels with a smaller commutation angle are more stable under alternate operating conditions. F.G.M.

A80-18162 Ocean energy - Forms and prospects. J. D. Isaacs and W. R. Schmitt (California, University, La Jolla, Calif.). *Science*, vol. 207, Jan. 18, 1980, p. 265-273. 48 refs.

The primary nonpetroleum power sources of the sea can be classified as mechanical (waves, tides and currents), chemical (salinity gradients and biomass), and thermal (temperature gradients, including ice). Power potential of each of these sources, their particular characteristics, geographic distribution, energy density and feasibility of practical utilization are analyzed. Waves, tides and currents are already employed to produce power. Examples of some existing practical devices which utilize tidal and wave power are: wave pumps, Salter's Duck power plants, and tidal power plants. Different approaches to utilizing other marine power sources are discussed. The complexity of practical devices for the extraction of power seems to vary with energy density, the salinity gradient requiring the most complex approaches and the currents the simplest. Even more important than direct utilization of ocean energy may be the use of seawater as a coolant and of the sediments below the seabed for the disposal of nuclear wastes. V.L.

A80-18165 Net energy analysis of alcohol production from sugarcane. C. S. Hopkinson, Jr. and J. W. Day, Jr. (Louisiana State University, Baton Rouge, La.). *Science*, vol. 207, Jan. 18, 1980, p. 302-304. 23 refs. NOAA-supported research.

Energy requirements were calculated for the agricultural and the industrial phase of ethyl alcohol production from sugarcane grown in Louisiana. Agricultural energy requirements comprised 54 percent of all energy inputs, with machinery, fuel, and nitrogen fertilizer representing most of the energy subsidies. Overall net energy benefits (output:input) for alcohol production ranged from 1.8:1 to 0.9:1 depending on whether crop residues or fossil fuels were used for industrial processes. (Author)

A80-18167 Linear synchronous motor development for urban and rapid transit systems. H. Weh (Braunschweig, Technische Universität, Braunschweig, West Germany). (Institute of Electrical and Electronics Engineers and American Institute of Physics, Joint International Magnetism Conference and Conference on Magnetism and Magnetic Materials, 2nd, New York, N.Y., July 17-20, 1979.) *IEEE Transactions on Magnetism*, vol. MAG-15, Nov. 1979, p. 1422-1427. 6 refs.

The following paper presents and discusses technical variants in magnetic suspension-repelling permanent magnets, electrodynamic and electromagnetic suspension methods, controlled lift magnets. In addition, propulsion methods for magnetically suspended vehicles are also shown. The synchronous long stator linear motor has achieved particular importance since it makes possible an efficient energy conversion. The load-carrying capacity is not reduced by the weight of the drive and the layout enables a very good integration of the lift and thrust functions. A further reduction of the on-board power requirements can be achieved by using permanent magnets to generate the rated induction in the air gap. Several magnetic suspension systems constructed or under construction with the long stator method are also mentioned. (Author)

A80-18184 Electric heat - The right price at the right time. J. G. Asbury, R. F. Geise, and R. O. Mueller (Argonne National Laboratory, Argonne, Ill.). *Technology Review*, vol. 82, Dec.-Jan. 1980, p. 32-40. 5 refs.

Four general types of efficient off-peak electric heating systems which could be commercialized in the U.S. for home heating as an alternative to gas and fuel oil systems are discussed. The four types could work through the introduction of lower off-peak rates. Electric storage heating systems use a storage medium (refractory brick, cast iron, water) to store off-peak electric energy in thermal form for application during peak hours. In bivalent heating systems oil- or gas-fired furnaces substitute for the electric heat during periods of high electricity demand. Electric heat pumps use a compression-expansion cycle to transfer about two units of thermal energy from outdoor to indoor air for each unit of electric energy consumed. Finally, electric heating is used as backup for residential solar heating systems. Advantages and limitations of each of the heating systems are discussed. A computer model is used to analyze the performance characteristics and operation costs of the heating systems and numerical results are presented. V.L.

A80-18213 A performance and current distribution model for scaled-up molten carbonate fuel cells. V. Sampath, A. F. Sammells (Institute of Gas Technology, Chicago, Ill.), and J. R. Selman (Illinois Institute of Technology, Chicago, Ill.). *Electrochemical Society, Journal*, vol. 127, Jan. 1980, p. 79-85. 11 refs.

The performance of scaled-up (100 sq cm) fuel cells with cross flow of fuel and oxidant has been modeled using the polarization characteristics of small-scale (3 sq cm) fuel cells. The model also yields the two-dimensional (superficial) current distribution. The performance predicted by the model approximates to within 4% the experimental data if a suitable average value is assigned to the effective cell impedance. The latter depends on the inlet gas composition but does not vary much with the current; its value may be estimated from small-scale cell data. Carbon monoxide conversion contributes appreciably to the performance of low Btu cells; it tends

to make the current distribution less uniform. The presence of methane must be considered in pressurized cells, but it does not appear to be formed to a significant extent. The relative contribution of mass transfer and kinetic resistance to the cell impedance are discussed in light of recent experimental results. (Author)

A80-18214 Power conversion efficiency monitoring in photoelectrochemical and other solar cells. B. Miller (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). *Electrochemical Society, Journal*, vol. 127, Jan. 1980, p. 184-188. 7 refs.

A device is described which incorporates a superimposed a-c voltage signal, current-voltage product generation, synchronous detection, and a feedback loop to bias a photovoltaic converter to its point of maximum power output. Examples of its operation as a continuous monitor of power conversion efficiency are given for p-n junction and photoelectrochemical cells. Applications to studying the design fundamentals of the latter are illustrated, based on control derived with two- and three-electrode configurations to evaluate response to efficiency determining parameters such as light intensity and mass transport in the cell. The circuit stably responds with the average values of power output under periodically interrupted light up to at least 10 Hz. These characteristics open the way to external power conversion spectroscopy in the ultraviolet to near infrared range. (Author)

A80-18231 Relating computer simulation studies with interface state measurements on MIS solar cells. J. K. Kim (RCA David Sarnoff Research Center, Princeton, N.J.), W. A. Anderson (New York, State University, Buffalo, N.Y.), and S. Hyland. *IEEE Transactions on Electron Devices*, vol. ED-26, Nov. 1979, p. 1777-1782. 18 refs. Research supported by the Rutgers Research Council; NSF Grant No. AER-73-03197.

A lock-in-amplifier technique has been used to measure interface state density (N_{ss}) values ranging from 2×10 to the 11 th to -3×10 to the 13 th states/sq cm eV depending on energy in the gap, type of Si substrate, and choice of Schottky metal used in MIS diodes. Polycrystalline, ribbon, and (100) single-crystal Si substrates with 40-60 interfacial oxides have been tested using Cr, Al, Ti, and Cu as Schottky metal. A computer simulation is used to predict the influence of interface states, interfacial oxide thickness, and Schottky metal on open-circuit voltage. The influence of Schottky metal on open-circuit voltage is also clearly seen. Very close agreement is shown between experimental and theoretical values. This study clearly relates experimental and theoretical data to permit design of more efficient MIS solar cells. (Author)

A80-18240 # An in-situ optical particle sizing technique. D. J. Holve (Stanford University, Stanford, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0020*. 10 p. 28 refs. Research supported by the Electric Power Research Institute; Contracts No. EEF-77-C-03-1481; No. N00014-79-C-0318.

This paper discusses the application of an in-situ optical counter to the measurement of liquid fuel droplets and solid coal particles under combustion conditions. Mie theory computations are used to determine an optimal near-forward light-scattering geometry for sizing both spherical transparent particles and irregularly shaped light-absorbing particles in the 5-80 micron range. Results are presented for a burning methanol spray and for reacting coal particles. (Author)

A80-18242 # High interaction subsonic MHD channel operation. R. Kessler, A. W. McClaine, and A. Solbes (Avco Everett Research Laboratory, Inc., Everett, Mass.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0022*. 9 p. 5 refs. Contract No. EF-77-01-2519.

Analytical and experimental investigations were conducted into the subsonic operation of MHD generator channels. Experiments were performed with a combustion-driven MHD channel in which transitions from supersonic flow to subsonic flow and vice versa were caused by varying the magnetic field strength. Subsonic operation under various conditions was verified by increases in combustor pressure with increases in magnetic field. Experimentally measured operating parameters were compared with predictions. Satisfactory agreement was generally found. (Author)

A80-18243 * # Results of duct area ratio changes in the NASA Lewis H2-O2 combustion MHD experiment. J. M. Smith (NASA, Lewis Research Center, Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0023.* 7 p.

MHD power generation experiments utilizing a cesium-seeded H2-O2 working fluid have been carried out using a diverging area Hall duct having an entrance Mach number of 2. The experiments are conducted in a high-field strength cryomagnet facility at field strengths up to 5 tesla. The effects of power takeoff location, generator loading, B-field strength, and electrode breakdown voltage have been investigated. In this paper the effect of area ratio, multiple loading of the duct, and duct location within the magnetic field are considered. (Author)

A80-18265 # Coal-fired open cycle MHD combustion plasmas - Chemical equilibrium and transport properties workshop results. L. D. Sullivan, J. E. Klepeis (U.S. Department of Energy, Magnetohydrodynamics Div., Germantown, Md.), W. J. Coderre (Dynatrend, Inc., Woburn, Mass.), and W. H. Fischer (Gilbert/Commonwealth, Reading, Pa.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0091.* 7 p.

For electrical power generation utilizing a high temperature alkali-seeded coal combustion plasma, the certainty of high electrical conductivity in the presence of coal ash and trace impurities is vitally important, especially for use in extrapolation of existing designs to higher power levels, as envisioned for commercial applications. The paper surveys the results of the workshop which provides an industry wide overview of the computational methods and analyses that are currently in use. Attention is given to uncertainty bands for plasma electrical conductivity. Also discussed are other issues such as coal, slag, seed, and conductivity. Finally, the paper gives suggested areas for further work. M.E.P.

A80-18191 Estimation of OH radical concentration in a propylene-NOx-dry air system. H. Akimoto, F. Sakamaki, G. Inoue, and M. Okuda (National Institute for Environmental Studies, Ibaraki, Japan). *Environmental Science and Technology*, vol. 14, Jan. 1980, p. 93-97. 17 refs.

A80-18297 * # Advanced solar thermal receiver technology. A. A. Kudirka and L. P. Leibowitz (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0292.* 10 p. 6 refs. Research sponsored by the U.S. Department of Energy.

Development of advanced receiver technology for solar thermal receivers designed for electric power generation or for industrial applications, such as fuels and chemical production or industrial process heat, is described. The development of this technology is focused on receivers that operate from 1000 F to 3000 F and above. Development strategy is mapped in terms of application requirements, and the related system and technical requirements. Receiver performance requirements and current development efforts are covered for five classes of receiver applications: high temperature, advanced Brayton, Stirling, and Rankine cycle engines, and fuels and chemicals. (Author)

A80-18298 * # Performance characteristics of point-focusing distributed-receiver solar Brayton systems. N. El Gabalawi (California Institute of Technology, Jet Propulsion Laboratory, Solar Thermal

Energy Systems Group, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0293.* 9 p. 10 refs. Research sponsored by the U.S. Department of Energy.

Due to variations in solar insolation, it may be necessary or desirable to operate solar energy systems continuously in off-design conditions. Design of solar energy systems should maximize system efficiency at the design point and throughout the range of operational solar insolation. The solar power system considered in this study consists of a point-focusing concentrator, a cavity receiver, an open cycle gas turbine engine, and a heat regenerator. A computer simulation model was developed to predict off-design system performance. Results showing system efficiency and associated subsystems interface requirements are presented for various turbine inlet temperatures and engine speeds. (Author)

A80-18299 # Use of adjustable flat mirrors with flat-plate collectors. D. C. Larson (Drexel University, Philadelphia, Pa.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0294.* 8 p. 14 refs.

Flat mirrors are frequently used to increase the heat output from flat-plate collectors. They are generally oriented in an east-west direction and are mounted below and/or above the collector panels. The annual performance of a mirror-boosted system can be improved by allowing periodic adjustments of the mirrors alone or of the panel-mirror units. In order to compare different mirror-panel configurations their solar flux concentration ratios are averaged over a yearly period using the solar elevation angle time probability function. All configurations have the same ratio of mirror area to panel area. In general it is found that the mirror orientations are more important than the panel orientations. Seasonal adjustments of the mirrors suffice to maintain acceptable values of the concentration and there is relatively little advantage in providing for collector panel adjustments. For year-round collection semiannual mirror adjustments provide a marked increase in output relative to fixed configurations. A double-mirror system (adjustable trough) provides higher concentrations than a single-mirror system for equal mirror area. Adjustable trough configurations with zero acceptance angle provide higher annual average concentration ratios than those with non-zero acceptance angles. (Author)

A80-18300 # A new solar thermal electricity/cooling generation system. J. T. Pytlinski and J. Cherng (New Mexico State University, Las Cruces, N. Mex.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0296.* 7 p. 20 refs.

The paper presents the results of a basic thermodynamic and economic study of a combined solar thermal electricity generation and refrigeration system employing a Rankine cycle or refrigeration cycle respectively. The study demonstrates the technical and economical feasibility of retrofitting a water-ammonia solar powered absorption refrigeration system with a turbine and electric generator for the purpose of electricity generation. Through optimization of the system, an increase in the solar energy conversion efficiency and a decrease in the payback period could be expected. (Author)

A80-18301 * # Experimental results of the solar heating system on the LSU field house. D. Maples (Louisiana State University, Baton Rouge, La.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0297.* 6 p.

Presented in this paper is an analysis of a solar heating system installed on the Louisiana State University Field House. A comparison between predicted performance and actual performance of the flat-plate collectors is discussed. The measured storage tank temperatures, solar insulations, and mean plate temperatures are presented as a function of the time of day for a given day and as three day averages. (Author)

A80-18303 * # Thermal barrier coatings for aircraft gas turbines. R. A. Miller, S. R. Levine, and S. Stecura (NASA, Lewis Research Center, Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0302.* 6 p. 13 refs.

Improvements in gas turbine performance are approaching the limits imposed by alloy properties and excessive cooling air requirements. Thin ceramic coatings can increase the difference between gas temperature and metal temperature by several hundred degrees. Thus, they are potentially a major step forward in surface protection. These coatings offer the potential to reduce fuel consumption by permitting reduced coolant flow or higher turbine inlet temperature or to improve durability by reducing metal temperatures and transient thermal stresses. At NASA Lewis, in-house and contractual programs are in place to bring this promising technology to engine readiness in the early 1980's. Progress towards this goal is summarized in this paper. (Author)

A80-18353 # Integral modeling of MHD channel boundary layers. J. Gertz, T. Opar, A. Solbes, and G. Weyl (Avco Everett Research Laboratory, Inc., Everett, Mass.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0175.* 11 p. Contract No. EF-77-01-2519.

New families of profiles are presented which are suitable for integral modeling of MHD electrode wall and side wall boundary layers. In the case of electrode walls, the total enthalpy profile is well represented by a cubic in velocity, which depends parametrically on the wall heat flux. Voltage drops are seen to first increase and then decrease with current density and channel size. For insulator walls, the proposed velocity profiles depart nearly linearly from classical power law profiles. Calculations for a typical subsonic CDIF channel show good agreement with the two dimensional code STAN-5. The effect of boundary layers on generator efficiency is discussed. (Author)

A80-18354 * # Off-design performance analysis of MHD generator channels. D. R. Wilson and T. S. Williams (Texas, University, Arlington, Tex.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0176.* 13 p. 16 refs. Grant No. NSG-3255.

A computer code for performing parametric design point calculations, and evaluating the off-design performance of MHD generators has been developed. The program is capable of analyzing Faraday, Hall, and DCW channels, including the effect of electrical shorting in the gas boundary layers and coal slag layers. Direct integration of the electrode voltage drops is included. The program can be run in either the design or off-design mode. Details of the computer code, together with results of a study of the design and off-design performance of the proposed ETF MHD generator are presented. Design point variations of pre-heat and stoichiometry were analyzed. The off-design study included variations in mass flow rate and oxygen enrichment. (Author)

A80-18355 # Convective heat transfer in MHD channels and its influence on channel performance. R. K. Ahluwalia and E. D. Doss (Argonne National Laboratory, Argonne, Ill.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0178.* 12 p. 16 refs.

The limitations of the integral boundary layer methods and the potential of the differential boundary layer method in analyzing MHD channel flows are assessed. The sensitivity of results from the integral method to the parametrization of boundary layer profiles and calculation of wall heat transfer is established. A mixing-length type turbulence model for flow on rough walls is developed and validated by comparison with experimental data. The turbulence model is used in a quasi-three-dimensional boundary layer model to evaluate the influence of wall roughness and pressure gradients on the flow characteristics and performance of MHD channels. The behaviors of skin friction and Stanton number calculated from the

analytical model are found to differ considerably from the empirical correlations valid for non-MHD flows without pressure gradients.

(Author)

A80-18366 # Design of heat pipe cooled laser mirrors with an inverted meniscus evaporator wick. K. T. Feldman, Jr. (New Mexico, University, Albuquerque, N. Mex.) and D. L. Noreen (Solar Energy Research Institute, Golden, Colo.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0148.* 7 p. 6 refs. Contract No. F29601-76-C-0132.

The heat pipe laser mirror is cooled by evaporation of a liquid from a porous wick on the backside of the mirror. The liquid is distributed over the surface by the capillary wick, eliminating the need for a liquid pump, piping, heat exchanger, and pumping power. Thus the heat pipe cooled mirror can be particularly valuable where compact, light weight, high heat flux mirrors are required. In this report an analysis of the hydrodynamic performance limits of a flat plate heat pipe evaporator is described. A thin copper plate is heated on one side and cooled on the other by evaporation of water from fine grooves fed by a liquid transport wick. This type of evaporator wick is known as the inverted-meniscus heat pipe evaporator. The analysis includes determination of the wicking limit for three composite wick designs and gives the optimum wick dimensions. (Author)

A80-18378 # Osmotically pumped energy transport system. A. Basiulis and D. J. Formiller (Hughes Aircraft Co., Torrance, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0210.* 5 p. 6 refs.

An osmotic heat pipe using commercially available membranes has been constructed and its continuous operation demonstrated. Principles of operation and technology status are considered along with polarization concentration effects, flow control, leakage through a membrane, and solute carryover. Evaluation of potential applications indicates that totally passive energy transport systems can be developed for applications such as deicing of leading edges of aircraft wings, helicopter rotor blades, cooling of electronics, and solar heating and cooling of buildings. V.T.

A80-18379 # Performance testing of a hydrogen heat pipe. J. Alario and R. Kosson (Grumman Aerospace Corp., Bethpage, N.Y.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0212.* 9 p.

Test results are presented for a reentrant groove heat pipe with hydrogen working fluid. The heat pipe became operational between 20 and 30 K after a cooldown from 77 K without any difficulty. Steady-state performance data taken over a 19 to 23 K temperature range indicated the following: (1) maximum heat transport capacity = 5.4 W-m; (2) static wicking height = 1.42 cm; and (3) overall heat pipe conductance = 1.7 W/C. These data agreed remarkably well with extrapolations made from comparable ammonia test results. The maximum heat transport capacity is 9.5% larger than the extrapolated value, but the static wicking height is the same. The overall conductance is 29% of the ammonia value, which is close to the ratio of liquid thermal conductivities (24%). Also, recovery from a completely frozen condition was accomplished within 5 min by simply applying an evaporator heat load of 1.8 W. (Author)

A80-18505 The use of oil shale for SO₂ emission control in atmospheric-pressure fluidized-bed coal combustors. W. I. Wilson, R. B. Snyder, and I. Johnson (Argonne National Laboratory, Argonne, Ill.). *I & EC - Industrial and Engineering Chemistry, Process Design and Development*, vol. 19, Jan. 1980, p. 47-51. 9 refs. Research sponsored by the U.S. Department of Energy.

Oil shale-SO₂ reactivity, determined with a thermogravimetric analyzer, was used to estimate the quantity of oil shale required to

reduce SO₂ concentration in the effluent gas sufficiently to meet the SO₂ emission standard in atmospheric-pressure fluidized-bed coal combustion (AFBC). It was calculated that the oil shale could reduce the SO₂ concentration in the effluent gas from FBC units below the SO₂ emission limit. In evaluating virgin oil shale and spent oil shale for SO₂ emission control, they were compared with (1) Germany Valley limestone, (2) Greer Limestone, and (3) Tymochtee dolomite. The results indicate that more oil shale than limestone or dolomite may be required to meet the SO₂ emission standard since the calcium content of the shale is relatively low. The attrition rate of Green River oil shale was similar to attrition rates of limestones and dolomites. (Author)

A80-18552 # Economic comparisons of solar and fossil total energy systems for industrial applications. G. D. Pine (Oak Ridge National Laboratory, Oak Ridge, Tenn.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/TS-6.* 8 p. 7 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. W-7405-eng-26.

Four industrial application case studies were completed comparing fuel cell, diesel, and solar central receiver total energy systems with boiler and grid-electric systems. All total energy systems save significant quantities of fuel compared with separate supply of electricity and heat. However, the fuel cell and diesel systems require natural gas and oil, respectively, and while using less total fuel, they may substitute the use of these fuels for more plentiful coal or uranium. Solar total energy systems, on the other hand, reduce not only total fuel consumption, but also the oil and gas consumption. Solar systems are relatively capital intensive, but show significant economies of scale. They were found to compete well with the other systems in sizes larger than two to three MWe, but not so well for smaller sizes. (Author)

A80-18553 * # Optimization of a point-focusing, distributed receiver solar thermal electric system. R. L. Pons (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-11.* 10 p. Members, \$1.50; nonmembers, \$3.00. Contract No. JPL-955115.

This paper presents an approach to optimization of a solar concept which employs solar-to-electric power conversion at the focus of parabolic dish concentrators. The optimization procedure is presented through a series of trade studies, which include the results of optical/thermal analyses and individual subsystem trades. Alternate closed-cycle and open-cycle Brayton engines and organic Rankine engines are considered to show the influence of the optimization process, and various storage techniques are evaluated, including batteries, flywheels, and hybrid-engine operation. (Author)

A80-18554 # Solar-powered liquid-metal MHD power systems. E. S. Pierson, G. Fabris, C. B. Reed (Argonne National Laboratory, Argonne, Ill.), and H. Branover (Argonne National Laboratory, Argonne, Ill.; Negev, University, Beersheba, Israel). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-22.* 8 p. 15 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the Ministry of Energy of Israel; Contract No. W-31-109-eng-38.

The two-phase liquid-metal MHD power cycles coupled to solar collectors have potentially a higher efficiency of converting solar energy input into useful electrical power output for all collector temperatures. The MHD interaction is a volume effect, so that efficiency is essentially independent of design power level down to fractional-megawatt size, and the performance is attractive even at approximately 50 kWe size. The use of two working fluids in the energy-conversion system is advantageous in coupling the conversion cycle to solar collectors and direct-contact boilers can be used to obtain, higher conversion system temperatures. Two liquid-metal MHD systems of interest for solar collectors are presented and explained. Liquid metal MHD conversion systems appropriate to low, intermediate, and high collector temperatures are described along with initial efficiency and cost results. (Author)

A80-18555 # A simplified procedure for performance of solar systems with heat pumps. F. Osterle, A. Murphy (Carnegie-Mellon University, Pittsburgh, Pa.), A. Salehpour, and P. Vercaemert. *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-23.* 12 p. 11 refs. Members, \$1.50; nonmembers, \$3.00.

A simple procedure is described and assessed for determining the annual heating and cooling energy requirements of a hypothetical small residential building in Pittsburgh, PA by four methods: (1) direct solar plus auxiliary for heating and heat pump for cooling, (2) unassisted heat pump plus auxiliary, (3) and (4) two solar heat pump combinations. The procedure used average daily temperatures and insolation for each month. The emphasis of the paper is on the modeling procedures developed rather than on the specific results presented. The use of the simplified procedure provides good results with great time saving compared to hour-by-hour performance modeling. (Author)

A80-18556 # Simulation of solar-assisted urban sewage digestion. T. Newell and R. Boehm (Utah, University, Salt Lake City, Utah). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-36.* 5 p. 8 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the Envirotech Corp.

In the present work, it was desired to simulate the quantitative aspects of solar augmentation of sewage digestion. Three solar-assisted configurations where heat is exchanged with combinations of the influent stream and the digester were investigated in this study. The three systems were modeled using a solar computer simulation program developed at the University of Utah. This simulation program performs half hour calculations of system energy flows. Year-long performance is summarized for solar and ambient temperature variations that are set by long-term averages while maintaining particular year variations. Typical urban sewage digestion plant designs for the location of Atlanta, Georgia, were used in the simulations. Plots of the solar system performance versus solar system size are presented for the three system configurations. Comparisons are made to residential system simulations. (Author)

A80-18557 # Utilization of heavy fill gases in annular solar receiver geometries for heat loss reduction. A. C. Ratzel (Sandia Laboratories, Albuquerque, N. Mex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-18.* 8 p. 11 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. DE-AC04-76DP00789.

Analytical and experimental work has investigated reducing thermal conduction and natural convection heat losses in annular solar receiver geometries using high molecular weight fill gases. Gases analyzed in a Sandia Laboratories prototype receiver design included nitrogen, argon, krypton, xenon, sulfur hexafluoride, and Freon C-318 R. Experimental results indicate that high molecular weight, monatomic gases can reduce receiver heat loss by nearly 50 percent, comparable to annulus gas evacuation to the 5.0 to 0.5 Pa range. Computer simulation studies show that heavy gas utilization in the annular space can improve overall collector performance by 4.5 to 13.5 percent, depending upon the gas and annulus pressure. (Author)

A80-18558 # Heat transfer analysis of receivers for a solar concentrating collector. M. P. Rice, M. F. Modest, D. N. Borton, and W. E. Rogers (Rensselaer Polytechnic Institute, Troy, N.Y.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-20.* 5 p. 7 refs. Members, \$1.50; nonmembers, \$3.00.

The heat transfer characteristics and performance of conically wound, single-layer monotube receivers for a concentrating solar collector are investigated. A discussion of methods and assumptions used to formulate the basic energy balances is presented. Results obtained from this analysis indicate the degree of sensitivity of performance to variations in tube radius, inlet temperature, ambient temperature, absorptivity of the tube coating, and cone half-angle within receiver size and mounting limitations. (Author)

A80-18559 # Computer simulation results for planar reflectors and flat plate solar collectors. F. A. Rudloff, S. R. Swanson, and R. F. Boehm (Utah, University, Salt Lake City, Utah). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-37.* 8 p. 14 refs. Members, \$1.50; nonmembers, \$3.00.

The benefits attributed to reflectors for increasing performance of flat plate collectors vary quite widely in the literature. In the present study, a detailed computer simulation is carried out to investigate the increase in performance. The results show that: (1) collectors should be placed at higher tilt angle than usual; (2) reflectors placed in front of the collectors can be tilted up 5 or 10 deg; and (3) performance has a broad peak with respect to tilt angle. The system performance enhancement in Salt Lake City, Utah ranges from 1.16 for domestic hot water to 1.28 for space heating for equal reflector-collector areas, and the break-even ratio of per area reflector to collector cost is from 16 to 28% for these systems.

(Author)

A80-18560 # A solar energy system with annual aquifer storage. W. J. Schaetzle, C. E. Brett (Alabama, University, University, Ala.), L. R. Fang, and D. M. Grubbs. *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-30.* 6 p. 8 refs. Members, \$1.50; nonmembers, \$3.00.

By utilizing a sufficiently large thermal energy storage system, solar energy can be collected the year round and utilized during relatively short periods. Solar energy collected in the summer can be used in the winter. In some cases, over four times as much solar energy can be collected per month in the summer versus collection per month in the winter. The actual capital cost of the solar system for heating with storage can be reduced by over a factor of two where adequate aquifers are available. Two examples are analyzed - one in Boston, Massachusetts and one in Birmingham, Alabama. The advantages of annual storage can decrease the capital costs appreciably. For heating in the northern parts of the continental United States, collector areas can be reduced by over 75 percent. This reduction will result in a similar reduction in capital cost, thereby increasing the feasibility of solar systems.

(Author)

A80-18561 # Effectiveness - NTU charts for latent heat storage units. N. Shamsundar (Houston, University, Houston, Tex.) and R. Srinivasan. *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-16.* 12 p. 13 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. EG-77-C-04-3974/EFT-5.

In recent papers, numerically obtained results were presented in which two-dimensional effects were accounted for. In these calculations, axial changes in fluid temperature and solidification rate were neglected, and the coolant temperature was assumed constant. In the present paper, these restrictions are removed. It is shown that complete three-dimensional results can be obtained from the numerical results of the two-dimensional analysis by performing rather simple calculations. The results are presented in the form of charts giving the effectiveness of a heat exchanger in terms of its size, as represented by the number of transfer units, the layout of the tubes in the heat exchanger, and the Biot number.

(Author)

A80-18562 # A home-size solar-powered engine for cooling systems of generation of electricity. F. O. Smetana, P. G. Bladen, and T. B. Dameron, III (North Carolina State University, Raleigh, N.C.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-34.* 12 p. Members, \$1.50; nonmembers, \$3.00.

The paper outlines the steps taken in designing and constructing a solar-powered engine at the N.C. State University, to produce sufficient electricity from sunlight to meet the needs of the average N.C. resident, estimated at being approximately 1000 KWH/month. Attention is given to the component selection and assembly, and an examination of the preliminary system operating results is given. Four criteria for the structure are outlined, including that the

structure be able to withstand 100 mph winds and that it requires only bolt-together assembly in relatively light-weight sections. C.F.W.

A80-18563 # Helium penetration in evacuated solar collectors - Theory and effect on their performance. J. R. Thomas, Jr. (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-17.* 4 p. 9 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

An important method of improving the thermal performance of solar collectors is to evacuate the region between collector surface and cover, thereby minimizing convection and conduction heat losses. Convection can be eliminated with modest vacuum levels, but elimination of conduction losses requires vacuum levels of 0.0001 Torr or higher. Vacuum durability becomes an important question for collectors operating under such hard vacuum conditions. Of particular interest are the effects of helium which is present in the atmosphere in the amount of 5 ppm and is known to penetrate most glasses. This paper gives results for helium permeation rates into evacuated collectors, and for the increase in heat loss that results.

(Author)

A80-18564 * # Comparative study of solar optics for paraboloidal concentrators. L. Wen, P. Poon, W. Carley (California Institute of Technology, Jet Propulsion Laboratory, Energy Technology Engineering Section, Pasadena, Calif.), and L. Huang (U.S. Navy, Civil Engineering Laboratory, Port Hueneme, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-8.* 13 p. 71 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy.

Different analytical methods for computing the flux distribution on the focal plane of a paraboloidal solar concentrator are reviewed. An analytical solution in algebraic form is also derived for an idealized model. The effects resulting from using different assumptions in the definition of optical parameters used in these methodologies are compared and discussed in detail. These parameters include solar irradiance distribution (limb darkening and circumsolar), reflector surface specular spreading, surface slope error, and concentrator pointing inaccuracy. The type of computational method selected for use depends on the maturity of the design and the data available at the time the analysis is made.

(Author)

A80-18565 # RAPAD - Real-time Accurate Performance Analysis of Data. L. Lewin, C. A. Baer, D. V. Pryor, C. B. Winn (Colorado State University, Fort Collins, Colo.), and B. W. Parkinson (Rockwell International Corp., Los Angeles, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-1.* 7 p. Members, \$1.50; nonmembers, \$3.00.

An innovative method for the real-time estimation of generic performance characteristics based on recursive least squares filtering is developed. After presenting the theoretical basis for the algorithm, its use is illustrated by applying it by computer simulation to a wind energy conversion system (WECS) whose true performance characteristics are assumed known. It is shown that good agreement between estimated and true performance is obtainable with as little as 1000 data samplings using a realistic level of instrumentation noise. This corresponds to approximately six days of WECS operation. The method is suitable for microprocessor implementation. This would result in the unique advantage of having a best estimate of system performance in real-time, thus alleviating labor-intensive and time-consuming data processing often necessary with conventional data acquisition procedures. Ongoing development, including implementation of the technique in conjunction with operational vertical and horizontal axis WEC systems, and optimization of the filter are discussed.

(Author)

A80-18566 # Addition of solar air heaters to a pre-engineered metal building. R. E. Forbes and R. W. McClendon (Mississippi State University, Mississippi State, Miss.). *American*

Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-33. 6 p. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

A80-18567 # Superheated steam generation in a Fresnel lens concentrating collector. R. E. Glass and P. R. Smith (New Mexico State University, Las Cruces, N. Mex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-21. 8 p. 16 refs. Members, \$1.50; nonmembers, \$3.00.*

Concurrent analytical and experimental studies were carried out on linear Fresnel lens solar collectors to determine their potential for producing superheated steam. Nine tracking Northrup collectors were connected in parallel as a single pass boiler. Flat plate collectors were used to preheat the water entering the Fresnel collectors, and superheated steam was produced for all cases. The results of the experimental study were used to verify the computer model developed to study Fresnel lens collectors. The computer model predicted the temperature profiles through the collector in all cases, including the occurrence of the critical heat flux point, and a parametric computer study was made of boiling in linear Fresnel lens collectors. (Author)

A80-18568 # Operational and parameter studies of a solar-powered absorption cycle system with internal latent energy storages. A. W. Harris (General Electric Co., Schenectady, N.Y.) and C. N. Shen (Rensselaer Polytechnic Institute, Troy, N.Y.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-27. 9 p. 8 refs. Members, \$1.50; nonmembers, \$3.00.*

Results of operational and parameter studies of a solar-powered heat pump system are presented. The system is based on an absorption cycle having a solar collector directly coupled to the generator with three latent energy storages internal to the cycle. The operational studies are concerned with the development of system design features and operating algorithms that cope with system constraints such as: emptying storage tanks, mixture strength limits, and system operating limits. (Author)

A80-18569 # The thermal design and analysis of an integrated sodium boiler/receiver for solar energy conversion. D. B. Osborn (Ford Aerospace and Communications Corp., Newport Beach, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-10. 6 p. 5 refs. Members, \$1.50; nonmembers, \$3.00.*

This paper presents the results of the thermal design and analysis of an integrated sodium boiler receiver used for solar energy conversion. The receiver is a major element of a point focus distributed receiver (PFDR) solar thermal-electric system employing Stirling engines for power conversion. The results of the design/analysis study show that a high temperature cavity receiver, employing pool-boiling sodium, is an excellent choice for use in dish-Stirling PFDR systems. The concept is technically feasible at the present time, employing state-of-the-art materials and technology, and will be a cost-effective subsystem when put into production. (Author)

A80-18570 # Design, evaluation, and testing of a moderately concentrating, non-tracking solar energy collector. A. Olvera and R. B. Bannerot (Houston, University, Houston, Tex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-3. 10 p. 33 refs. Members, \$1.50; nonmembers, \$3.00.*

The thermal performance of a moderately concentrating, non-tracking solar energy collector is predicted based on a series of experimental evaluations of its components. Four reflector designs were constructed and tested. Six simple tubular receiver designs and a collector utilizing one of the reflector designs and one of the receiver designs were constructed and tested. The predicted performance closely approximated the actual thermal performance of the

collector. The component evaluations are discussed in detail, so that the analysis can be extended to other designs. (Author)

A80-18571 # Horizontal-axis wind generator performance with varying tip speed ratio and rotor orientation. W. F. O'Brien and J. M. Hinerman (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-2. 7 p. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Agriculture.*

An experimental investigation of the performance of a horizontal-axis wind generator was conducted with varying rotor tip speed ratio and orientation relative to wind directions. The machine tested had a rotor diameter of 6.6 m, and a three-phase alternator with diode-rectified output. Rotor speed was controlled by changing the voltage level of the battery load. Operation at varying tip speed ratio (blade tip speed/wind speed) was thus produced. Rotor orientation relative to wind direction (yaw) was controlled by adjusting the position of a steering tail mounted on the wind generator. Values of performance coefficient C_p are calculated for the various data points, using an elliptical model for projected rotor area. The results are considered to be useful for guidance in the design of performance-optimizing control systems and power-limiting devices for horizontal-axis wind generators. (Author)

A80-18572 # An average slope factor for solar insolation. R. L. Field (Texas A & M University, College Station, Tex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-41. 6 p. 6 refs. Members, \$1.50; nonmembers, \$3.00.*

Design methods for solar collector sizing (such as f-chart) usually require a multiplying factor (the slope factor) to correct insolation data taken on the horizontal for the tilt angle of the solar collector. Available slope factor data were averaged and were re-plotted to result in a chart whose parameters are latitude and month of year. Correction charts for off-average locations are presented. The error in the given standard slope factor chart is estimated to be accurate + or - 5 percent for many cities. (Author)

A80-18573 # Optimization and comparison strategies for solar energy systems. R. C. Estes and W. Kahan (Singer Corporate Research and Development Laboratory, Fairfield, N.J.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-26. 13 p. 8 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. EG-77-C-03-1467.*

An analytical model of several simple, generic solar energy systems, with and without heat pumps is described. The model is augmented by marginal analysis to configure the components of each system type for an economic optimum and consequently, for maximum marketability. This model is to be used as a first-cut means of identifying the combinations of ranges of system component parameters and general geographic regions for which each generic configuration is most marketable. Assessment of marketability includes the following considerations: the size of the capital investment, the operating cost savings relative to alternative systems, future cost of energy, and cost of money. The following six systems types are optimized (where appropriate) and compared: (1) an all electric resistance heating system, (2) a stand-alone heat pump system, (3) a stand-alone solar energy system, (4) a series solar assisted heat pump (SAHP) system, (5) a parallel SAHP system, and (6) a dual source SAHP system. (Author)

A80-18574 # The simulation of building heat transfer for passive solar systems. A. F. Emery, C. J. Kippenhan, D. R. Heerwagen, and G. B. Varey (Washington, University, Seattle, Wash.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-38. 7 p. 6 refs. Members, \$1.50; nonmembers, \$3.00. U.S. Department of Social and Health Services Contract No. 8072-FGF-10432.*

A numerical simulation program, based upon a finite difference nodal network, was used to simulate two Los Alamos test cells (one single and one multi-room cell) and a typical residence - all of which

were exposed to intense insolation and large changes in ambient weather conditions. For the test cells, the predicted surface and globe temperatures are in good agreement with the measured values and indicate the acceptability of thermal modeling. The program was used to predict the behavior of a residential structure. The process of refining these predictions, guided by observations, led to the development of a stepwise simulation methodology. The insights gained as a result of this interdisciplinary involvement have been stimulating and instructive. The importance of recognizing the differences in the thought processes and the work styles of the several professions has been demonstrated. The most effective simulation methodology was that based upon human comfort, which appeared to be a common perception among all the program users.

(Author)

A80-18575 # Thermal energy utilization in the Mississippi County Community College Photovoltaic Project. F. K. Deaver, W. D. Turner (Arkansas, University, Fayetteville, Ark.), and W. H. Woodsmall, Jr. (Cromwell, Neyland, Truemper, Levy, and Gatchell, Inc., Little Rock, Ark.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-29.* 6 p. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

The first DOE funded solar photovoltaic demonstration project at the Mississippi County Community College in Blytheville, Arkansas is examined. One of the features of the project, the cooling loop for the silicon cells and the subsequent utilization of the thermal energy to supply heat to the building are described in detail. The overall configuration of the Solar Photovoltaic Conversion System includes four major functional subsystems: the collection subsystem, the power conditioning system, the solar energy control subsystem, and the collector cooling/thermal subsystem.

C.F.W.

A80-18576 # Evaluation of a solar heating system installed in the LSU Field House. D. Maples (Louisiana State University, Baton Rouge, La.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-31.* 6 p. Members, \$1.50; nonmembers, \$3.00.

As a demonstration in the use of solar energy, a solar system was installed on the Louisiana State University Field House. The system is capable of handling most of the hot water load and a small part of the space heating load required by the Field House. A mathematical model of the solar heating system was also developed. This model is capable of predicting the performance of the system using the following parameters: incident solar flux, outside ambient temperature; wind velocity and the amount of makeup water for the hot water system. A comparison between the predicted performance and the actual performance of the system was made. Control strategies and system parameters were varied to gauge the effect on the system. Finally, the flat-plate collector efficiency as a function of inlet water temperature was determined.

(Author)

A80-18577 # Noniterative solution of heat transfer equation of fluid flow in solar collector. J. P. Chiou (Detroit, University, Detroit, Mich.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-24.* 6 p. 23 refs. Members, \$1.50; nonmembers, \$3.00.

If the longitudinal heat conduction in the absorber plate and the tube wall of the solar collector are significant, thermal analysis of the fluid flowing through the collector tube generally requires an initial assumption of the fluid temperature distribution. Iteration scheme is then used in the analysis until the actual fluid temperature distribution is found. In this paper, a more efficient noniterative method for determination of this temperature distribution is presented. Collector efficiencies of a typical flat plate solar collector are calculated by this method for various operating conditions. The results are found to be in excellent agreement with those calculated by conventional techniques.

(Author)

A80-18578 # An optimization formulation for solar hot water systems. K. K. Chang and A. Minardi (Central Florida, University, Orlando, Fla.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-36.* 9 p. 24 refs. Members, \$1.50; nonmembers, \$3.00.

neers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-42. 7 p. 6 refs. Members, \$1.50; nonmembers, \$3.00.

A mathematical correlation between collector area and auxiliary energy used in a solar hot water system was obtained by using TRNSYS program. Based on this correlation, optimum collector area was directly related to both economic factors and system parameters. A criteria for economic feasibility was obtained. A comparison of optimum area calculated by this analysis with optimum area based on f-chart data was in good agreement.

(Author)

A80-18579 # SOLSTEP - A computer model for predicting the thermodynamic and economic performance of solar thermal power plants. S. P. Bird (Battelle Pacific Northwest Laboratory, Richland, Wash.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-12.* 8 p. 9 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

A thermodynamic and economic performance analysis code, SOLSTEP, was developed to facilitate the evaluation of solar thermal power plant designs. The code conducts a time step simulation of the plant thermodynamic performance using actual recorded meteorological and insolation data. Each analysis case provides capacity factor and leveled energy cost results for several plant configurations using various combinations of collector field size and storage capacity. The code has been used to analyze a variety of solar thermal generic concepts involving several collector types and energy conversion and storage subsystems.

(Author)

A80-18580 # A design method for optimizing collector systems for small solar central receivers. R. B. Bannerot and C. L. Laurence (Houston, University, Houston, Tex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-14.* 9 p. 12 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy.

The design methodology for the determination of the optimal heliostat field designs is presented in detail for a small solar central receiver. The optimization process is reviewed. Cost and performance models are discussed. To illustrate the design process, a representative small solar central receiver system is optimized. Cost factors were developed from current prices. The individual heliostat design and cost data were taken from the design of the ten megawatt-electric Barstow Pilot Plant design. A north field configuration, steel guyed tower and a tilted, circular aperture, cavity receiver were utilized. It is demonstrated that solar central receiver systems are more cost effective at higher power levels, above those considered here. But this fact has nothing to do with relative cost effectiveness of competing small, stand-alone, power systems.

(Author)

A80-18581 # SHADE - A computer model for evaluating the optical performance of two-axis tracking parabolic concentrators. W. J. Apley (Battelle Pacific Northwest Laboratory, Richland, Wash.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-13.* 7 p. 7 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy.

A computer model SHADE (Selection of Heliostat Arrangement for Distributed Engines) has been developed at the Pacific Northwest Laboratory to aid in determining the optical performance of two-axis tracking parabolic concentrators. The shading of individual mirror assemblies in a field of parabolic dishes determines the optimal field arrangement and the most efficient method of plant operation. SHADE provides a simple and inexpensive analytical tool for examining certain design aspects of solar thermal power systems using a network of point-focusing parabolic concentrators.

(Author)

A80-18582 # Analysis of convective heat loss from the receiver of solar power plants. L. S. Yao and F. M. Chen (Illinois, University, Urbana, Ill.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-36.* 9 p. 24 refs. Members, \$1.50; nonmembers, \$3.00.

The receiver of solar power plants is modeled as a semiinfinite vertical cylinder. The analysis is carried out to investigate the convective heat loss. Constant surface temperature is selected as the idealized condition for the receiver. Heat loss from the receiver is due to the combined mode of the free convection and the forced convection. The problem is studied under the condition that a steady horizontal breeze passes the receiver. The forced convection is treated as a perturbed effect. The solution shows that the free convection dominates the heat loss along the bottom of the cylinder. (Author)

A80-18583 # Preliminary analysis of a total solar heating system. C. B. Winn, P. Burns, E. Trigg (Colorado State University, Fort Collins, Colo.), and J. Leflar (SEEC, Inc., Fort Collins, Colo.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-40.* 7 p. Members, \$1.50; nonmembers, \$3.00.

The thermal and economic performances of long-term storage solar systems have been studied by use of a computer simulation developed at Colorado State University. The systems have been analyzed for Madison, Wisconsin and Boulder-Denver, Colorado. The effects of long-term storage size, long-term storage insulation and collector tilt angle have been detailed. Economic analyses indicate savings vs. long-term storage volume for various values of rock box insulation. Also, some interesting heat transfer effects are presented. Results indicate that long-term storage systems perform well where the annual heat load is high and the values of winter insolation are low. Also, relatively small (142 cu m) storage volumes performed most economically. (Author)

A80-18584 * # A solar thermal electric power plant for small communities. R. J. Holl (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-7.* 12 p. 9 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy and NASA.

A solar power plant has been designed with a rating of 1000-kW electric and a 0.4 annual capacity factor. It was configured as a prototype for plants in the 1000 to 10,000-kWe size range for application to small communities or industrial users either grid-connected or isolated from a utility grid. A small central receiver was selected for solar energy collection after being compared with alternative distributed collectors. Further trade studies resulted in the selection of Hitec (heat transfer salt composed of 53 percent KNO₃, 40 percent NaNO₂, 7 percent NaNO₃) as both the receiver coolant and the sensible heat thermal storage medium and the steam Rankine cycle for power conversion. The plant is configured with road-transportable units to accommodate remote sites and minimize site assembly requirements. Results of the analyses indicate that busbar energy costs are competitive with diesel-electric plants in certain situations, e.g., off-grid, remote regions with high insolation. Sensitivity of energy costs to plant power rating and system capacity factor are given. (Author)

A80-18585 # A comparison of test results for flat-plate water-heating solar collectors using the BSE and ASHRAE procedures. J. P. Jenkins and J. E. Hill (National Bureau of Standards, Washington, D.C.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-4.* 13 p. 10 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy.

Five solar collectors were tested according to the BSE and ASHRAE test procedures and the results compared. All five collectors tested were modular, flat-plate, water heating, and included single- and double-glazed designs with and without selectively coated absorbers. In both procedures, collector efficiency curves are determined. The ASHRAE procedure consists exclusively of outdoor testing whereas the BSE procedure requires a combination of outdoor and indoor testing (no irradiation) to determine the collector's optical and thermal loss characteristics, respectively. During the indoor testing in this study, the environmental test

conditions were controlled and regulated by use of specially built environmental simulators to investigate the effect of wind speed and 'sky' temperature on the thermal loss characteristics of the collectors. (Author)

A80-18586 * # Small solar thermal electric power plants with early commercial potential. H. E. Jones, D. J. Bisantz, R. N. Clayton, H. H. Heiges, and A. C. Ku (General Electric Co., Schenectady, N.Y.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-9.* 8 p. 5 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. JPL-955116.

Cost-effective small solar thermal electric power plants (1- to 10-MW nominal size) offer an attractive way of helping the world meet its future energy needs. The paper describes the characteristics of a conceptual near-term plant (about 1 MW) and a potential 1990 commercial version. The basic system concept is one in which steam is generated using two-axis tracking, parabolic dish, and point-focusing collectors. The steam is transported through low-loss piping to a central steam turbine generator unit where it is converted to electricity. The plants have no energy storage and their output power level varies with the solar insolation level. This system concept, which is firmly based on state-of-the-art technology, is projected to offer one of the fastest paths for U.S. commercialization of solar thermal electric power plants through moderate technology advances and mass production. (Author)

A80-18587 # Performance of heat pumps at elevated evaporating temperatures - With application to solar input. E. A. Kush (Brookhaven National Laboratory, Upton, N.Y.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-19.* 9 p. 10 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the U.S. Department of Energy.

The paper presents theoretical predictions, results of systematic experiments run on a special heat pump simulator, and interpretation/analysis of how high Coefficients of Performance (COP) heat pumps can be used in installed Solar Assisted Heat Pump (SAHP) systems. The residential application of heat pumps is discussed and an emphasis is placed on liquid source heat pumps - liquid source affording more efficient heat exchange, water tank thermal storage, and compatibility with earth sources. It is concluded that heating COP's which increase substantially with source (and evaporating) temperature are attainable with capacity modulating compressors, large heat exchangers and proper expansion device. C.F.W.

A80-18588 * # The effects of regional insolation differences upon advanced solar thermal electric power plant performance and energy costs. A. F. Latta, J. M. Bowyer, and T. Fujita (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-15.* 10 p. 11 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. DE-A101-79ET-20307.

This paper presents the performance and cost of four 10-MWe advanced solar thermal electric power plants sited in various regions of the continental United States. Each region has different insolation characteristics which result in varying collector field areas, plant performance, capital costs, and energy costs. The paraboloidal dish, central receiver, cylindrical parabolic trough, and compound parabolic concentrator (CPC) comprise the advanced concepts studied. This paper contains a discussion of the regional insolation data base, a description of the solar systems' performances and costs, and a presentation of a range for the forecast cost of conventional electricity by region and nationally over the next several decades. (Author)

A80-18589 # Comparison of predicted and measured solar energy system performance. J. C. Mears, Jr., J. M. Nash, and J. T. Smok (IBM, Federal Systems Div., Gaithersburg, Md.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-39.* 7 p. 12 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. EG-77-C-01-4049.

The paper describes the comparison methods of solar energy between the measured performance data and the data from an f-chart analysis. The results of the comparison demonstrate that it is possible to utilize FCHART to generate monthly performance references for selected systems if suitable inputs to the program are defined. This approach enables the realization of two important goals: the establishment of a monthly performance reference for the National Solar Data Network, and further verification of the validity of f-chart as a design aid. Four systems were selected from the NSDN to illustrate expected performance prediction analysis. The systems include: (1) an air space heating and domestic hot water system, (2) a large liquid domestic hot water system, and (3) a liquid space heating and domestic hot water system. C.F.W.

A80-18590 # Comparisons of measured and simulated performance for CSU Solar House I. J. W. Mitchell, W. A. Beckman (Wisconsin, University, Madison, Wis.), and M. J. Pawelski (Trane Co., LaCrosse, Wis.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-35.* 5 p. 7 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. E(11-1)-2588.

The solar heating system for CSU Solar House I is simulated using TRNSYS, and simulation results are compared to the measured performance. The heating system is composed of a liquid collection and storage system, a domestic hot water system, and an air delivery system. The components were modeled using standard TRNSYS components. Weather data recorded at the site were employed as the driving function. Measured energy quantities were compared to those from the simulation for three periods of six to eleven days each and on both a daily basis and over the entire period. The simulated energy quantities agree with the data within the accuracy of the measurements. Simulated values of storage tank temperatures generally agree within 2C of the measured values. These results help establish the validity of simulation methods for system analysis.

(Author)

A80-18591 # Residential solar heat pump systems - Thermal and economic performance. J. H. Morehouse and P. J. Hughes (Science Applications, Inc., McLean, Va.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-25.* 9 p. 21 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. DE-8C04-78CS-34261.

This study performed an analysis of series and parallel configured solar heat pump systems for residences. The year-round thermal performance for all the heating, cooling and hot water system configurations were determined by simulation and compared against conventional heating and cooling systems in three geographic locations. The series and parallel combined solar heat pump systems investigated are at best marginally competitive, on a 20-year life-cycle cost basis, with conventional oil and electric furnace systems. The combined solar heat pump systems are not economically competitive with conventional gas furnace or stand-alone heat pump systems for residential space heating, cooling and water heating.

(Author)

A80-18592 # Design of the International Energy Agency 500 kWe distributed-collector solar thermal-electric powerplant. T. W. Neumann and C. D. Hartman (Acurex Corp., Alternate Energy Div., Mountain View, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Sol-6.* 7 p. Members, \$1.50; nonmembers, \$3.00.

This paper reviews the results of engineering studies for an International Energy Agency (IEA) project for the design and construction of a 500-kWe (net) solar thermal-electric power generation system of the distributed collector system (DCS) type. The project is part of the IEA Small Solar Power System (SSPS) Project, and is being constructed as a demonstration plant in the province of Almeria in southern Spain. The DCS system design was completed by a 10 nation team. Construction is presently underway. The design consists of a mixed field of parabolic trough-type solar collectors of both German and U.S. design which are used to heat a thermal heat transfer oil.

(Author)

A80-18593 # The influence of thermophysical properties on the design and sizing of geothermal power plant components. H. E. Khalifa (United Technologies Research Center, East Hartford, Conn.) and J. Kestin (Brown University, Providence, R.I.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-18.* 7 p. 19 refs. Members, \$1.50; nonmembers, \$3.00. Contract No. EY-76-S-02-4051-A002.

The paper presents a study of the influence of uncertainties in the thermophysical properties of the working fluids on the preliminary design and sizing of the major components of a power plant. The effect of these uncertainties is discussed first qualitatively to characterize the nature of the problems resulting from them, then quantitatively to determine the relative magnitude of the differences in component design and size that would result if a power plant is designed on the basis of different sets of working fluid properties. Special emphasis is placed on isobutane which appears to be attractive for geothermal energy extraction. (Author)

A80-18595 # A solar assisted and wind powered heat pump for residential dwellings. E. Spero (Basic Automation, Ltd., Jerusalem, Israel) and A. Dybbs (Case Western Reserve University, Cleveland, Ohio). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-33.* 10 p. 14 refs. Members, \$1.50; nonmembers, \$3.00.

This paper presents a practical and cost-effective design of a residential energy system. The system combines the use of solar collectors and a wind turbine with a water to air heat pump. The wind turbine is directly coupled to the compressor of the heat pump and a thermal energy generator, thus eliminating intermediate stages and improving energy conversion efficiency. Proper matching between collection and conversion elements eliminates the need for complex speed controls. The system was simulated on a digital computer using hourly wind, temperature, and total daily isolation data for the Cleveland, Ohio, area. The results indicate that the collector and storage elements are smaller than expected because of the high degree of matching between the solar and wind energy availability and demand, along with an increased probability that one of these energy sources will be available. (Author)

A80-18596 # Solar thermal central receiver systems. D. L. Siebers, M. Abrams, and R. J. Gallagher (Sandia Laboratories, Livermore, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-38.* 6 p. 17 refs. Members, \$1.50; nonmembers, \$3.00.

Research needs in the thermal sciences relevant to the development of the solar central receiver concept are identified. The primary need is the creation of theoretical and empirical tools to predict energy loss from cavity and external receivers due to combined natural and forced convection heat transfer. The possibility of using boundary layer suction to reduce the convective energy loss is explored. The technique is found to be advantageous if the energy in the withdrawn air is recovered. In an unrelated problem area, a test to quantify boiling-induced thermal fatigue in a solar receiver is described. (Author)

A80-18600 # Multi-pass solar heater with heat-exchanging passes and exposed to non-uniform radiation. N. M. Rafat, M. M. Elkoth, and M. F. El-Refaie (Cairo University, Cairo, Egypt). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-67.* 8 p. 9 refs. Members, \$1.50; nonmembers, \$3.00.

This is an analytical treatment of the multi-pass solar fluid-heater when the received radiant energy is nonuniformly distributed in the cross direction, normal to the flow. Adjacent passes are allowed to exchange energy. Closed-form formulas are derived for the fluid and wall temperature distributions along different passes. Mathematical expressions are presented for two performance indices, the efficiency and the effectiveness. (Author)

A80-18620 # A vortex model of the Darrieus turbine - An analytical and experimental study. J. H. Strickland, B. T. Webster, and T. Nguyen (Texas Tech University, Lubbock, Tex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York,*

N.Y., Dec. 2-7, 1979, Paper 79-WA/FE-6. 6 p. 16 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the U.S. Department of Energy.

An aerodynamic prediction model has been formulated for two- and three-dimensional Darrieus turbines using a vortex lattice method of analysis. Experiments were conducted on a series of two-dimensional rotor configurations in a water tow tank. The agreement between analysis and experiment was in general found to be good. This model should allow one to make accurate predictions of instantaneous aerodynamic blade forces and to characterize the near wake flow behind the rotor. (Author)

A80-18623 # Fiscal year 1978 experiences at TVA's Widows Creek unit 8 limestone scrubber. W. L. Wells, J. F. Shiau, and J. H. Buckner (Tennessee Valley Authority, Chattanooga, Tenn.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/APC-10*. 15 p. 6 refs. Members, \$1.50; nonmembers, \$3.00.

The report updates TVA's experiences with its first full-scale limestone scrubber. A status report is given on operational and maintenance problems, including discussion of solutions found for some of these and a listing of others in the yet-to-be-resolved category. In addition, some of the results obtained from 12 monitoring points are outlined. Emphasis is on the changes observed as a function of time. Also discussed is the chemistry in the absorber and venturi circulation loops. The impact of the scrubber reheater on turbine cycle efficiency and scrubber system auxiliary power consumption are presented. Finally, an attempt is made to assess the cost of the flue gas desulfurization facility, considering all the factors proper to such an evaluation. M.E.P.

A80-18627 # Feasible thermophysical conditions for gas receiver tubes in solar power stations. M. Becker (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Cologne, West Germany). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-37*. 10 p. 7 refs. Members, \$1.50; nonmembers, \$3.00.

Heat transfer to air in turbulent pipe flow is analyzed and numerically computed. This is applied to estimate the energy transfer process in a solar thermal receiver of a central tower facility. The general condition of uniformly heated pipe flow will be discussed with dependence on, e.g., heat flux (10 to 1000 kW/m²), inlet pressure (4 to 80 bar), and tube radius (10 to 40 mm). For technical and economical optimization, the combination of high heat flux and high pressure is recommended. Thus, for a solar power station with gas as heat transfer medium, the closed thermal cycle is favored.

(Author)

A80-18631 # An evaluation of thermal energy storage for residential air conditioning applications. J. W. Jones and T. J. Small, III (Texas, University, Austin, Tex.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/HT-31*. 9 p. 6 refs. Members, \$1.50; nonmembers, \$3.00.

The application of daily cycle thermal energy storage in residential air conditioning has significant potential for energy use management. The purpose of this study has been to evaluate the technical feasibility of two thermal storage systems and to determine the possible energy and economic benefits of their use. A computerized load analysis and system simulation procedure was used to determine the power requirements of both storage and conventional air conditioning system for a 1600-sq ft residence. The results obtained indicate that thermal storage could have a positive impact on utility load profiles. It could also result in operating cost savings to homeowners under proposed time-of-day rate schedules, but the high initial cost makes storage systems a marginal investment at present. The results indicate that the impact on residential energy conservation ranges from negligible to somewhat negative. (Author)

A80-18637 # A small hybrid solar closed-cycle gas turbine cogeneration plant concept based on today's technology. C. F. McDonald (General Atomic Co., San Diego, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/GT-3*. 14 p. 41 refs. Members, \$1.50; nonmembers, \$3.00.

There are currently several possibilities for conversion of solar energy into electrical power (i.e., direct conversion, steam plant, open-cycle gas turbine, and closed-cycle gas turbine), with differing degrees of complexity, technology readiness, cost, and development requirements. This paper emphasizes a low technology approach of combining a closed-cycle gas turbine power conversion system, operating at a very modest temperature, and a point-focusing distributed receiver system consisting of parabolic dish concentrators with focal-mounted heat source exchangers, and a centralized prime-mover. The utilization of existing and proven technology is also emphasized, and aspects of the power conversion and heat source systems for a small plant concept are discussed. (Author)

A80-18644 # Screening evaluation of electric power cycles integrated with coal gasification plants. S. P. Gallagher (General Electric Co., Schenectady, N.Y.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Ener-4*. 8 p. Members, \$1.50; nonmembers, \$3.00.

The paper presents the results of an investigation of potentially lower cost alternatives to present concepts for integrated gasification combined cycle power plants. The study aimed to determine if a gasification system integrated with a reduced cost power plant could provide an attractive thermal efficiency; the cost reduction was achieved by removing the steam-bottoming system from a combined cycle so that only the gas turbine remained. The cycle efficiencies were determined for this non-bottomed cycle and several steam-bottom systems, using current and advanced gas turbines. Based on these performances, an economic overview was made comparing the capital cost and efficiency differences of competing systems. A.T.

A80-18645 # Novel power generation cycles using coal gas. R. V. Garland (Westinghouse Electric Corp., Combustion Turbine Systems Div., Concordville, Pa.) and M. J. Gluckman (Electric Power Research Institute, Palo Alto, Calif.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Ener-5*. 10 p. Members, 1.50; nonmembers, \$3.00.

This paper presents the results of a screening study on power cycles integrated with a coal gasification plant. Three basic plant configurations are studied: (1) the Condensing Combined Cycle, the most common combined cycle, which includes combustion turbines, gas expanders and condensing steam turbines. This configuration should be considered as the base case; (2) the Single Cycle, which is comprised of combustion turbines and gas expanders, but no steam turbines; (3) the Non-Condensing Combined Cycle, which utilizes combustion turbines, gas expanders and a non-condensing steam turbine. The gasifier used throughout is the Texaco entrained, coal slurry-fed, air blown gasification system along with a scrubber, sulfur removal system and a tail gas treater. (Author)

A80-18646 # Novel gas turbine cycles with coal gasification. S. Hamilton (United Technologies Corp., Power Systems Div., South Windsor, Conn.) and S. J. Lehman (United Technologies Research Center, East Hartford, Conn.). *American Society of Mechanical Engineers, Winter Annual Meeting, New York, N.Y., Dec. 2-7, 1979, Paper 79-WA/Ener-6*. 7 p. 6 refs. Members, \$1.50; nonmembers, \$3.00. Research sponsored by the Electric Power Research Institute.

This paper summarizes the results of a study to devise efficient gas turbine cycles without steam bottoming for use with coal gasification. Substitution of other forms of heat recovery in place of steam bottoming offers a potential cost saving. A novel form of the intercooled-reheat-regenerative cycle was devised with thermal efficiency nearly as high as that of combined cycles. As an additional finding, a reference gasified coal combined cycle power plant with

current technology gas turbines was shown to be potentially more efficient than current coal-fired steam power plants with flue gas desulfurization. (Author)

A80-18721 **Transmission of tidal energy over a plateau.** R. A. Heath (New Zealand Oceanographic Institute, Wellington, New Zealand). *Deutsche Hydrographische Zeitschrift*, vol. 32, no. 6, 1979, p. 289-296. 6 refs.

Variations in the response to an incident long wave on a step function plateau are considered as a function of the angle of incidence. Only for large angles of incidence is there a substantial change in the modulus of the amplitude ratio of the transmitted to incidence wave. The amplitude of the wave on top of the plateau varies strongly with the angle of incidence. Zero transmission can occur only if there is a net increase in depth across the plateau in the direction of the incident wave, the critical angle of incidence being independent of frequency. If the modulus of the angle of incidence is greater than the critical angle, wave energy is trapped along the trailing escarpment of the plateau. (Author)

A80-18728 * **Are large concentration of atomic H storable in tritium-impregnated solid in H₂ below 0.10 K.** G. Rosen (Drexel University, Philadelphia, Pa.) and R. W. H. Webber (Iowa, University, Iowa City, Iowa). *Nuovo Cimento, Lettere, Serie 2*, vol. 26, Dec. 22, 1979, p. 579-585. 7 refs. Grant No. NSG-7491.

The storage and release of atomic hydrogen produced by the beta decay of tritium contained in a crystalline solid H₂ matrix at concentrations greater than 2% and temperatures below 0.80 K are investigated. The temperature of a sample chamber containing tritium-impregnated H₂ and placed in the mixing chamber of a dilution refrigerator was measured as the chamber was heated and cooled in order to determine the rates of energy storage and release. It is found that for samples containing 1.2 wt.% tritium, after storage at 0.054 K for 40 h, an increase in sample temperature to a trigger point of 0.17 K leads to an energy release due to the destabilization of atomic H in H₂ as predicted by the phenomenological rate process theory. For a tritium weight fraction of 2.5%, energy releases were triggered at 0.54 and 0.82 K after storage at 0.080 K, indicating the trapping of H atoms at the sites of T₂ and HT molecules in the sample. The application of a 15 kG magnetic field is shown to increase the storage capacity of T₂ traps while reducing that of HT traps, and to lower the trigger temperatures of both. Results suggest that the direct conversion of nuclear energy to chemical energy may become technically feasible in the future. A.L.W.

A80-18733 # **Energetics aspects of environmental protection (Energeticheskie aspekty zashchity okruzhaiushchei sredy).** S. S. Kutateladze, V. N. Moskvicheva, B. I. Psakhis, V. K. Shitov, and L. A. Ogurechnikov. *Akademiia Nauk SSSR, Izvestiia, Energetika i Transport*, Nov.-Dec. 1979, p. 84-97. 10 refs. In Russian.

Consideration is given to means of effectively utilizing low-temperature heat and toxic wastes produced by chemical and petrochemical processing installations. Means developed for the reduction of thermal wastes in the major energy processing industries and for the processing and recovery of solid, liquid and gaseous chemical-process industrial effluents are presented. Of the more than 20 types of apparatus developed by the Thermophysical Institute of the Siberian Academy of Sciences in the last five to seven years, it is noted that the most important processes make use of boiling and condensation, together with gas/liquid interactions, film flow, bubbling and stream flow, while heat and mass transfer processes have not yet been investigated sufficiently. The technical and economic effectiveness of the various processes are also evaluated. A.L.W.

A80-18734 # **Automobile transportation and the environment (Avtomobil'nyi transport i okruzhaiushchaia sreda).** D. P. Velikanov. *Akademiia Nauk SSSR, Izvestiia, Energetika i Transport*, Nov.-Dec. 1979, p. 98-109. 8 refs. In Russian.

The problem of the pollution of the atmosphere by substances released by automobiles burning petroleum-derived fuels is reviewed. The production of carbon monoxide, hydrocarbons, nitrogen oxides and sulfur by gasoline, diesel and gas engines is quantified, and the

introduction of pollution-free electric automobiles is considered in terms of the limitations imposed by the current state of battery technology. Measures taken to control automobile pollution in the United States are presented, including the use of catalytic converters and improvements to the fuel system and combustion chamber and predictions of air pollution levels in major cities in the USSR by 1990 are presented. The introduction of maximum allowable pollutant levels in the Soviet Union and the measurement of engine emissions are reported, and planned conversion to electric vehicles, replacement of lead as an antiknock ingredient, and increased fuel efficiency by means of equal fuel and air distribution to each cylinder and combustion gas recirculation are presented. The use of nonpolluting hydrogen fuel is also evaluated. A.L.W.

A80-18735 **Fluid bed combustion in processing, environmental protection and energy supply.** L. Reh (Lurgi Chemie und Hüttentechnik GmbH, Frankfurt am Main, West Germany). (*American Flame Research Committee, International Fluidized Bed Combustion Symposium, Boston, Mass., Apr. 30-May 1, 1979.*) *Erdöl und Kohle Erdgas Petrochemie vereinigt mit Brennstoff-Chemie*, vol. 32, Dec. 1979, p. 560-566. 65 refs.

Following a brief review of the history of development of fluid bed combustion the advantages of the fluid bed principle for an environmentally favorable combustion at low temperatures and the conditions of different fluidizing states applicable to combustion are discussed. Hereby the importance of the radial mixing behavior of fluidizing gas and fluidized solids for achieving the desired uniformity of fluid bed temperatures is mentioned. Applications of fluid bed combustion of different fuels in processing, in environmental protection and in energy supply are explained. In process techniques a description is given of the regeneration of used HCL-pickle liquors and the calcination of aluminum trihydrate in a circulating fluid bed. In environmental processing, the incineration of sludge in compact fluid bed and combined multiple hearth/fluidized bed furnaces is described, as, in energy supply techniques, is the roasting of sulphidic ores and the new development of coal combustion in a circulating fluid bed for exclusively supplying steam or heat. (Author)

A80-18746 **International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge University, Cambridge, England, August 10-12, 1978, Lectures.** *Journal of Photochemistry*, vol. 10, Jan. 1979. 135 p. (For individual items see A80-18747 to A80-18752)

Articles are presented on energy storage in organic photoisomers, light induced electron transfer reactions, photo-galvanic cells, as well as on photoelectrochemistry and heterogeneous photocatalysis at semiconductors. Other subjects include the physics and chemistry of solar cells and synthetic molecular organizes. C.F.W.

A80-18747 **Energy storage in organic photoisomers.** G. Jones, II, S.-H. Chiang, and P. T. Xuan (Boston University, Boston, Mass.). (*International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge, England, Aug. 10-12, 1978.*) *Journal of Photochemistry*, vol. 10, Jan. 1979, p. 1-18. 69 refs. Research supported by the U.S. Department of Energy.

Criteria for the successful photochemical storage of solar energy as latent heat in organic materials are outlined. Photoisomerization reactions which have some potential for storage of photon energy in kinetically stable products are surveyed. Emphasis is placed on well-known internal cyclo-additions which display thermal reversibility, large storage capacities and high chemical and quantum efficiencies. Chemicals available on an industrial scale, which are known to undergo valence isomerization, are identified, and attempts to drive these reactions via exciplexes (complexes involving strong electron donor or electron acceptor sensitizers) are described. The sensitized isomerization of dimethylnorbornadiene-2,3-dicarboxylate and a model compound, hexamethyldewarbenzene, are identified as bona fide exciplex isomerizations. Triplet sensitizers have been employed in the sensitization of 7 to visible light (to 500 nm) and the potential importance of endothermic energy transfer in triplet sensitization (the upconversion of very low energy triplets) is

discussed. The review includes developments by several research groups in the spectral sensitization of isomerizable substrates, the use of heterogeneous photosensitizers, and photocalorimetric techniques.

(Author)

A80-18749 Photogalvanic cells. W. J. Albery and A. W. Foulds (Imperial College of Science and Technology, London, England). (*International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge, England, Aug. 10-12, 1978.*) *Journal of Photochemistry*, vol. 10, Jan. 1979, p. 41-57. 27 refs.

The theory of the operation of the ideal photogalvanic cell for solar energy conversion is described and the crucial kinetic characteristics that the system must possess are deduced for the homogeneous kinetics, the mass transfer and the electrode kinetics. Existing iron-ruthenium and iron-thionine systems are discussed with respect to the ideal characteristics. In the case of the iron-ruthenium system the kinetics of the thermal back reaction are too rapid and the cell does not have differential electrode kinetics. The iron-thionine system satisfies many of the criteria. A thionine-coated electrode possesses the necessary differential electrode kinetics. Sulphonated thionine is to be preferred to ordinary thionine in that it is more soluble. The performance of the iron-thionine cell with respect to the ideal cell is analyzed and discussed.

(Author)

A80-18750 Photoelectrochemistry and heterogeneous photocatalysis at semiconductors. A. J. Bard (Texas, University, Austin, Tex.). (*International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge, England, Aug. 10-12, 1978.*) *Journal of Photochemistry*, vol. 10, Jan. 1979, p. 59-75. 73 refs. Research supported by the Robert A. Welch Foundation and NSF.

The principles and applications of semiconductor electrodes in photoelectrochemical (PEC) cells (liquid junction photovoltaic, photoelectrosynthetic, photocatalytic) are described. Factors important to the design of practical systems and the extension of the principles of PEC cells to particulate systems for carrying out heterogeneous photocatalysis and photosynthesis are discussed. A 'dual n-type semiconductor' model of biological photosynthesis is proposed and possible means of utilization of such a system is described.

(Author)

A80-18751 The physics and chemistry of solar cells. K. W. Böer (Delaware, University; SES, Inc., Newark, Del.). (*International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge, England, Aug. 10-12, 1978.*) *Journal of Photochemistry*, vol. 10, Jan. 1979, p. 77-110. 52 refs. Research supported by SES, Inc.

The physics of the photovoltaic effect is analyzed using the example of a frontwall solar cell. The effect results from the interplay of the emitter, in which minority carriers are generated via absorbed light and diffuse to the junction, and the junction, in which the essential voltage drop occurs. The interplay is established by the minority carrier density at the emitter-junction interface, acting as prominent boundary condition, and connecting current through the device with applied voltage. The chemistry of the interlayer between emitter and junction has essential influence on this boundary condition by determining interface recombination and space charge. Both of these determine band connection and performance of the device. A brief review of material properties in the light of the basic cell operation is given.

(Author)

A80-18752 Synthetic molecular organizes. H. Kuhn (Max-Planck-Institut für biophysikalische Chemie, Göttingen, West Germany). (*International Conference on the Photochemical Conversion and Storage of Solar Energy, 2nd, Cambridge, England, Aug. 10-12, 1978.*) *Journal of Photochemistry*, vol. 10, Jan. 1979, p. 111-132. 27 refs.

Organized systems of molecules (organizes) can be obtained by assembling monolayers of planned composition and architecture. Appropriately constructed monolayer assemblies can be used to study light-induced vectorial charge separation. Such systems are of interest in designing devices for solar energy conversion. Possibilities

of such devices are discussed and experiments are presented to demonstrate light-induced charge separation. Charge separation is limited by the quantum mechanical tunnelling effect which cannot be avoided at molecular dimensions. Experiments to study that effect are described. Monolayer assemblies to discriminate between different mechanisms of spectral sensitization of photoeffects by dyes are discussed and cases are considered where an increased spectral sensitization is achieved by cooperation of different dye molecules.

(Author)

A80-18797 Space light - Space industrial enhancement of the solar option. K. A. Ehrlicke (Space Global, La Jolla, Calif.). *Acta Astronautica*, vol. 6, Dec. 1979, p. 1515-1633. 34 refs.

The paper considers space light systems which provide an opportunity for the application of space technology to the enhancement of the solar energy uses in industrial countries. The space light functions range from night illumination of rural and urban areas (Lunetta systems) to photosynthetic production enhancement for the growth of food and biomass for conversion to chemical fuels; to electric power generation by irradiating photovoltaic or thermal ground receivers at night or by adding to the natural solar energy input in daytime (Soletta systems). The Lunetta and Soletta concepts are reviewed, and an assessment of terrestrial alternatives is made; the Lunetta, Powersoletta, and a large Biosoletta space light systems are selected for large-scale seafood production in Antarctic and Arctic waters. Models are developed for rural and urban lighting, power generation with photovoltaic and thermal ground stations, and for the large-scale production of seafood.

A.T.

A80-18800 Cost effectiveness requirements for space power stations. G. K. C. Pardoe (General Technology Systems, Ltd., Brentford, Middx., England). *Acta Astronautica*, vol. 6, Dec. 1979, p. 1745-1752.

The concept of converting solar energy in orbital space stations and transmitting electrical power to Earth at radio frequency, is receiving increasing attention both in paper studies and experimental and development work. The projects conceived are large in scale and implications and will demand major resources in their development and deployment. This paper, therefore, examines the requirements which together will determine the appropriate levels of cost effectiveness of space power stations and should assist in establishing critical or sensitive areas which will influence the operational validity of the concepts. The r.f. transmission of electric power to and from, or between, spacecraft may itself have wider implications and is another aspect considered in the paper. In summary, the paper does not seek to introduce new design concepts, but appraises the situation and exposes indicators concerning cost effectiveness.

(Author)

A80-18832 Properties of gases and petroleum liquids derived from terrestrial kerogen at various maturation levels. J. Connan and A. M. Cassou (Société Nationale Elf-Aquitaine /Production/, Département Laboratoire de Géologie, Pau, Pyrénées-Atlantiques, France). *Geochimica et Cosmochimica Acta*, vol. 44, Jan. 1980, p. 1-23. 48 refs.

The paper presents a study dealing mainly with shale-sandstone series in which the disseminated kerogen is mostly composed of land-derived debris. Organic matter was characterized by microscopic and chemical techniques, while the kerogen maturity was assessed by microscopic studies, mainly by means of vitrinite reflectance measurements. The oil and gas properties are tentatively interpreted in terms of maturity, using a comparison of oil properties with the kerogen features of shales interbedded in the impregnated sandstone reservoirs. In low maturity stages (immature zone), dry gas with minor condensate is observed, whereas in higher maturity levels (oil window), wet gas with high paraffinic crudes is generally recorded. Shallow depth condensates and their related gases have been identified as immature fluids. In conclusion, it is noted that the study offers a maturity frame work as a guide for oil and gas prediction in shale sandstone sequences containing land derived kerogen.

M.E.P.

A80-18833 The distribution of sulfur and organic matter in various fractions of peat - Origins of sulfur in coal. D. J. Casagrande, K. Gronli, and N. Sutton (Governors State University, Park Forest South, Ill.). *Geochimica et Cosmochimica Acta*, vol. 44, Jan. 1980, p. 25-32. 25 refs. Research supported by the Governors State University and NSF.

A80-18849 # Pollution aspects of oilfired and coalfired boilers. C. M. Deshpande and S. C. Kale (Associated Industrial Consultants, Bombay, India). *Indian Journal of Air Pollution Control*, vol. 2, Jan. 1979, p. 24-28.

A80-18859 First experiences with the use of impactors in large power plants (Erste Betriebserfahrungen über den Einsatz von Impaktoren in Grosskraftwerken). W. Jockel (Technischer Überwachungsverein Rheinland, Cologne, West Germany). (*Internationales Kolloquium über polycyclische aromatische Kohlenwasserstoffe*, Hanover, West Germany, Sept. 18-21, 1979.) *Staub - Reinhaltung der Luft*, vol. 39, Dec. 1979, p. 474-475. In German.

In conjunction with gravimetric dust measurements with a filter head device, the grain distribution of pure gas dust was determined by means of a cascade impactor. The measurements were made in the flue gas of a powerplant fuelled by bituminous coal. The equipment consisted of an Andersen Mark III impactor which was equipped with a manual partial flow sampling system instead of a filter head device. Attention is given to the preparation of the fiberglass filter, operation of the impactor, and evaluation of the results. M.E.P.

A80-18861 Experiences with the practical use of an Andersen cascade impactor in the exhaust gas of various industrial sites (Erfahrungen beim praktischen Einsatz eines Andersen-Kaskadenimpaktors im Abgas verschiedener Industrieanlagen). K. Lütke and W. Muhr (Rheinisch-Westfälischer Technischer Überwachungsverein, Essen, West Germany). (*Internationales Kolloquium über polycyclische aromatische Kohlenwasserstoffe*, Hanover, West Germany, Sept. 18-21, 1979.) *Staub - Reinhaltung der Luft*, vol. 39, Dec. 1979, p. 477, 478. In German.

A80-18868 Gasification of solid waste in a fluidized bed reactor with circulating sand. M. Hasegawa, J. Fukuda (Tsukishima Kikai Co., Ltd., Tokyo, Japan), and D. Kunii (Tokyo, University, Tokyo, Japan). *Conservation and Recycling*, vol. 3, no. 2, 1979, p. 143-153. Research supported by the Ministry of International Trade and Industry.

The paper reports on the operation of a demonstration plant in Japan using a process which can gasify a variety of solid materials such as organic sludge, waste plastics, municipal wastes and spent tires. It is shown that plastic rubbish is particularly suitable as a feedstock for this process which can produce a considerable amount of clean fuel gas with a high calorific value. It is concluded that the operability, safety and flexibility of the demonstration plant verified the adequate application of the process for pollution-free treatment of solid materials. M.E.P.

A80-18870 The microbial production of methane from household wastes - Fixed-bed anaerobic digestion. N. W. Le Roux, D. S. Wakerley, and M. N. Simpson (Warren Spring Laboratory, Stevenage, Herts., England). *Conservation and Recycling*, vol. 3, no. 2, 1979, p. 165-174. 18 refs.

Putrescible fractions of sorted household waste were anaerobically digested in fixed-bed tests. At 30 C, digestion was almost completed in 60 days when unfragmented waste was inoculated and submerged with digested sludge. The gas yield was approximately 0.12 cu m/kg of putrescible waste with an average composition of 58% CH₄ + 42% CO₂, but initially the percentage of methane was low. With water, instead of a digested sludge inoculum, about 160 days was required for digestion. Digestion of fragmented waste, even with CaCO₃, was slower than with unfragmented material. At 15 plus or minus 3 C the digestion of inoculated fragmented waste required about 280 days. Practical and economic aspects of operating fixed-bed methane fermentations are discussed. (Author)

A80-18871 The basics of magnetic separation as applied to municipal solid waste reclamation plants. E. H. Richard (Magnetics International, Inc., Maple Heights, Ohio; Stearns Magnetics, Inc., Cudahy, Wis.). *Conservation and Recycling*, vol. 3, no. 2, 1979, p. 187-197. 5 refs.

Magnetic separation of ferrous metallics from municipal solid waste is based on technology developed for, and profitably applied to, ore beneficiation, slag reclamation, automobile shredding, and scrap processing industries. No one system or type of magnet can be used for all ferrous waste recovery. Above all, the system must initially be engineered into the process to provide recovery of a product that is readily marketable. Various magnet arrangements in the recovery system separate, clean and transport the recycled ferrous material. There are a number of basic magnetic system configurations and typical applications, some of which are presented here. (Author)

A80-18883 Control technology for coal-fired combustion in Northeastern U.S. A - Overview and sulfur emissions control. B - Particulates, NOx and combined systems. E. N. Ziegler and R. E. Meyers (Brookhaven National Laboratory, Upton, N.Y.). *Water, Air, and Soil Pollution*, vol. 12, Oct. 1979, p. 355-369, 371-381. 111 refs.

The status of air pollution control technology for coal-fired industrial and power plant boilers has been surveyed. Lime and limestone based scrubbers are capable of removing as much as 93% of flue gas SO₂ at facilities supplying 800 MW power. The Wellman-Lord, thiosorbic, and citrate processes are capable of producing salable products instead of the sludge. Electrostatic precipitators, the major control device for removing particulates, can eliminate 99.5% of the fine particles. Fabric filtration can remove 99.9% and is more efficient in the 0.2 to 2 micron size range than ESPs. Utilization of fabric filters is expected to increase significantly from its present 5% of the particulate removal market. Nitrogen oxide concentrations in coal fired systems are usually reduced by modification of the combustion system. Various process capital and annualized costs are reported for SO₂ and particulate removal systems. The status of fluidized bed combustion, fuel desulfurization, conversion of coal to gaseous and liquid fuels, and flue gas denitrification is also discussed. Part A deals with S emissions; Part B with NOx, particulates, and combined systems. (Author)

A80-18990 Principles of photoelectrochemical solar energy conversion. M. A. Butler and D. S. Ginley (Sandia Laboratories, Albuquerque, N. Mex.). *Journal of Materials Science*, vol. 15, Jan. 1980, p. 1-19. 66 refs. Contract No. DE-AC04-76DP00789.

Photoelectrochemical devices for conversion of solar energy into both electrical energy and chemical energy are discussed with emphasis on how the various material properties of the photoactive electrodes influence device efficiency and stability. The similarity between photoelectrochemical cells (PECs) and solid state devices is used to model their behavior and optimize such parameters as band gap, doping level, minority carrier lifetime, etc. A model is presented which calculates the electron affinity of any semiconductor and allows the prediction of the open circuit voltage of wet photovoltaic cells and optimum biasing for chemical producing cells. The effects of absorbed ions at the semiconductor/electrolyte interface are reviewed. The temperature dependence of the energy levels in the semiconductor and the electrolyte are considered and the implications of these results to operation of PECs at elevated temperature are discussed. The major differences between PECs and solid state devices are the stability considerations. The thermodynamics of this problem is discussed. Other important degradation mechanisms and some solutions to these problems are reviewed. Finally, a prognosis of the future of this field is presented. (Author)

A80-19000 On the substitution of petroleum by other energy sources - Using the energy economics of West Germany as an example (Zur Frage der Substitution von Mineralöl durch andere Energieträger - Dargestellt am Beispiel der Energiewirtschaft eines Bundeslandes). U. Dolinski and K.-D. Labahn. *Energiewirtschaftliche Tagesfragen*, vol. 29, Dec. 1979, p. 740-745. 6 refs. In German.

The paper discusses the necessity for substituting other energy sources for the rapidly decreasing amount of available petroleum as the demand increases. Three factors are important in developing alternate means: (1) the available supply possibilities of other energy sources, (2) the willingness to substitute of the oil users, as well as (3) the availability of technical substitution potential. Among the alternate sources examined are anthracite, ligneous coal, natural gas, nuclear power, electric energy, and remote heating systems. C.F.W.

A80-19031 Controllable d.c. power supply from wind-driven self-excited induction machines. D. B. Watson, J. Arrillaga (Canterbury, University, Christchurch, New Zealand), and T. Densem (New Zealand Electricity, Christchurch, New Zealand). *Institution of Electrical Engineers, Proceedings*, vol. 126, Dec. 1979, p. 1245-1248. 10 refs.

A variable-speed generating system is described which uses a 3-phase squirrel-cage induction machine with self-excitation capacitors. The variable-frequency/variable-voltage generated is then fed through a 3-phase controlled rectifier to provide a d.c. supply at constant voltage. The proposed scheme is suitable for wind power sources as it allows wide changes in wind turbine speed and, at all speeds, optimum generating power can be set up by rectifier delay angle control. (Author)

A80-19048 Heat flow and heat transfer conditions in the bottom sediments of the equatorial Indian Ocean. R. I. Kutas, M. I. Beviuk, and V. F. Vygovskii (Akademii Nauk Ukrainskoi SSR, Institut Geofiziki, Kiev, Ukrainian SSR). *Geothermics*, vol. 8, no. 1, 1979, p. 31-36. 9 refs.

The results are reported of heat flow determinations during the 10th and 11th cruises of the 'Akademik Vernadsky'. Geothermal gradients were measured by the thermograd PTG-2MTB, with two temperature sensors of 1 or 1.2 m spacing. The temperature sensors were fixed to the coring tube. The lower sensor penetrated the sediment to a depth of 2.5 m. On board determinations of thermal conductivity were made by one of two methods: the needle probe method and analysis of water content in sediments. Twenty-one heat flow measurements ranging from 4 to 120 mW/sq m have been obtained. The heat flow values depend on the type and granulometric composition of the sediments. High values are obtained on the southern slope of the Karlsberg Ridge, in the zones where bottom sediments have been found to have the maximum content of pelitic fraction and minimum of foraminifera. Low values of heat flow are due to a long-term effect of the ascending hydrothermal flow. This is confirmed by the traces of hydrothermal activity found in the sediments. (Author)

A80-19049 The Bullaren lineament, southwestern Sweden - A possible site for geothermal heat extraction. J. Hanson (California, University, Livermore, Calif.), K. Ahlborn, S. A. Larson, and G. Lind (Chalmers Tekniska Hogskola, Goteborg, Sweden). *Geothermics*, vol. 8, no. 1, 1979, p. 37-53. 19 refs. Contract No. W-7405-eng-48.

A80-19201 Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, September 12-16, 1977, Proceedings. Workshop sponsored by the Ente Nazionale per l'Energia Elettrica and ERDA. Edited by E. Barbier. *Geothermics*, vol. 7, no. 2-4, 1978. 225 p.

Activity in reservoir physics and engineering and resource assessment (particularly in central and southern Tuscany) in the field of geothermal research and development is reported. Pressure transient studies made from well tests in the geologically and hydrologically complicated Travale-Radicondoli (Italy) reservoir, as well as an analysis of pressure and of decline curves in the Serrazzano reservoir are presented. In addition, the thermodynamic behavior of the Bagnore geothermal field, reservoir performance of the Geysers Field (Calif.), and an evaluation of Baltazor known geothermal

resources area (Nevada), are discussed, and an estimate of the resource potential of New Zealand geothermal fields for power generation is presented. J.P.B.

A80-19202 Methods for regional assessment of geothermal resources. P. Muffler (U.S. Geological Survey, Menlo Park, Calif.) and R. Cataldi (Ente Nazionale per l'Energia Elettrica, Centro Ricerca Geotermica, Pisa, Italy). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 53-89. 61 refs.

The paper describes the EEA-3/1 geothermal assessment methodology developed jointly by the United States and Italy. The goals of EEA-3/1 were: (1) to provide a comprehensive evaluation of geothermal resource assessment techniques in a report that can serve as a basis for future discussion and refinement of assessment methodology; (2) to propose geothermal resources methodology that is compatible with established usage in the mining and petroleum industries, yet takes into account the peculiar characteristics of geothermal energy; (3) to propose a methodology for forthcoming refinements and revisions of geothermal resource assessment in the United States and Italy; and (4) to stimulate the careful attention of geothermal resources specialists to questions of geothermal resources methodology, particularly with respect to terminology, assumptions, limitations, and documentation. B.J.

A80-19203 Assessment of geothermal potential of central and southern Tuscany. R. Cataldi (Ente Nazionale per l'Energia Nucleare, Centro Ricerca Geotermica, Pisa, Italy), A. Lazzarotto (Siena, Università, Siena, Italy), P. Muffler (U.S. Geological Survey, Menlo Park, Calif.), P. Squarci (CNR, Istituto Internazionale per le Ricerche Geotermiche, Pisa, Italy), and G. Stefani (Ente Nazionale per l'Energia Elettrica, Florence, Italy). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 91-131. 13 refs.

A80-19204 Analysis of reservoir pressure and decline curves in Serrazzano zone, Larderello geothermal field. P. Atkinson (Union Oil Company of California, Santa Rosa, Calif.), F. G. Miller (Stanford University, Stanford, Calif.), R. Marconcini, G. Neri (Ente Nazionale per l'Energia Elettrica, Gruppo Minerario, Larderello, Italy), and R. Celati (CNR, Istituto Internazionale per le Ricerche Geotermiche, Pisa, Italy). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 133-144. 9 refs.

An estimate of reserves in the Serrazzano reservoir was obtained from mass balance studies and production decline curve analyses. The straight-line p/z vs cumulative production material balance relationship was applied to vapor-dominated geothermal reservoirs. Furthermore, an empirical type curve matching technique was applied to the production decline curves of wells in the reservoir; an estimated total production (past and future) of 200,000,000 tons was obtained. The agreement between the estimated total production using material balance principles and decline curve analyses was found to be remarkably good. B.J.

A80-19205 Thermodynamic behaviour of the Bagnore geothermal field. P. Atkinson (Union Oil Company of California, Santa Rosa, Calif.), R. Celati (CNR, Istituto Internazionale per le Ricerche Geotermiche, Pisa, Italy), R. Corsi (Ente Nazionale per l'Energia Elettrica, Centro Ricerca Geotermica, Pisa, Italy), F. Kucuk (Science Applications, Inc., Morgantown, W. Va.), and H. J. Ramey, Jr. (Stanford University, Stanford, Calif.). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 185-208. 10 refs.

The paper examines the thermodynamic behavior of the Bagnore, Italy, geothermal field. Hydrogeological data and the history of watering-out of wells on the field periphery were

examined, noting that the depth of fracture in these wells can be correlated with the gas-water interface in the reservoir. A mathematical model which accounts for thermodynamic and chemical equilibria between the vapor, liquid, and solid carbonate phases in the reservoir was applied to a study of initial conditions in the reservoir; a lumped-parameter CO₂-H₂O liquid-vapor model was used to calculate history of pressure and composition for the reservoir. The research confirms the existence of a large accumulation of non-condensable gas in the reservoir drawn off during the first years of exploitation; calculations with the producing-state lumped-parameter model indicate that the long-term producing concentration of CO₂ cannot be accounted for by assuming reasonable amounts of CO₂-saturated liquid-water influx. A.T.

A80-19206 Evaluation of Baltazor known geothermal resources area, Nevada. W. F. Isherwood and D. R. Mabey (U.S. Geological Survey, Menlo Park, Calif.). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 221-229. 9 refs.

By virtue of the Geothermal Steam Act of 1970, the U.S. Geological Survey is required to appraise geothermal resources of the United States prior to competitive lease sales. This appraisal involves coordinated input from a variety of disciplines, starting with reconnaissance geology and geophysics. This paper describes how the results of several geophysical methods used in KGRA evaluation were interpreted by the authors, two geophysicists, involved with both the Evaluation Committee and the research program responsible for obtaining and interpreting the geophysical data to be used by the committee. (Author)

A80-19207 The United Nations' approach to geothermal resource assessment. J. R. McNitt. (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 231-242. 49 refs.

Although the emphasis of United Nations' assisted geothermal projects has been on demonstrating the feasibility of producing geothermal fluids, the potential capacity of individual fields has been estimated by both the energy in place and decline curve methods. The energy in place method has been applied to three geothermal fields resulting in total resource estimates ranging from 380 to 16,800 MW-yr. The decline curve method has not given quantitative results concerning ultimate field potential because of the relatively short duration of well tests (several weeks to a maximum of 11 months). A new method for making regional assessment of geothermal potential is described, which is based, in part, on an assessment of the probable range of the power potential of geothermal fields as inferred from a frequency distribution analysis of fields already under development throughout the world. Depending on the reservoir containing dry steam or water, and its location in a region of groundwater recharge or discharge, average power potentials can be expected to range from 36 to 3360 MW. (Author)

A80-19208 An estimate of the resource potential of New Zealand geothermal fields for power generation. I. G. Donaldson (Department of Scientific and Industrial Research, Physics and Engineering Laboratory, Lower Hutt, New Zealand) and M. A. Grant (Department of Scientific and Industrial Research, Applied Mathematics Div., Wellington, New Zealand). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 243-252. 5 refs.

The basic similarity between most of the New Zealand geothermal fields suggests that the exploited fields of Wairakei and Broadlands can be used as indicators of the potential of other fields as resources for steam for power production. Assuming adequate permeability will be obtained in fields yet to be tested, the two parameters controlling this potential are areal extent (as defined by resistivity survey) and temperature at depth. As most field temperatures are bracketed by Wairakei (270 C maximum) and Broadlands

(310 C maximum), field potential per unit area should also be bracketed by the field potentials per unit area of these two fields, i.e. Wairakei at 10-11 MWe per sq km and Broadlands at 12-14 MWe per sq km. Based upon present knowledge of the fields in question it may be possible to assess their proven, inferred and speculative reserves. Our totals for all fields of 450 MWe proven, 750 MWe inferred and 1300 MWe speculative suggests that New Zealand has some 1300-2500 MWe available from its geothermal resources should it desire to exploit these for electrical power. (Author)

A80-19209 Transient-pressure analysis in geothermal steam reservoirs with an immobile vaporizing liquid phase. A. F. Moench (U.S. Geological Survey, Menlo Park, Calif.) and P. G. Atkinson (Union Oil Company of California, Santa Rosa, Calif.). (*Ente Nazionale per l'Energia Elettrica and ERDA, Workshop on Geothermal Resource Assessment and Reservoir Engineering, Larderello, Italy, Sept. 12-16, 1977.*) *Geothermics*, vol. 7, no. 2-4, 1978, p. 253-264. 14 refs. Research supported by the Ente Nazionale per l'Energia Elettrica, ERDA, and NSF.

A finite-difference model for the radial horizontal flow of steam through a porous medium is used to evaluate transient-pressure behavior in the presence of an immobile vaporizing or condensing liquid phase. Graphs of pressure drawdown and buildup in terms of dimensionless pressure and time are obtained for a well discharging steam at a constant mass flow rate for a specified time. The assumptions are made that the steam is in local thermal equilibrium with the reservoir rocks, the temperature changes are due only to phase change, and that effects of vapor-pressure lowering are negligible. Computations show that when a vaporizing liquid phase is present the pressure drawdown exhibits behavior similar to that observed in noncondensable gas reservoirs, but delayed in time. A theoretical analysis allows for the computation of this delay and demonstrates that it is independent of flow geometry. The response that occurs upon pressure buildup is markedly different from that in a noncondensable gas system. This result may provide a diagnostic tool for establishing the existence of phase-change phenomena within a reservoir. (Author)

A80-19275 # Combustion and turbulence characteristics of cyclone combustors for burning low calorific value fuels. S. E. Najim, A. C. Styles, and N. Syred (University College, Cardiff, Wales). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0075*. 8 p. 13 refs. Research supported by the Science Research Council.

This paper describes an experimental investigation in which the combustion of low calorific value gases in a cyclone combustor are simulated by dilute mixtures of natural gas and air (mixture ratio = 1.68). The flame front formed is annular and is located close to the chamber walls. Detailed measurements of the combustion aerodynamics and pollution characteristics of the burner are presented which show low flame front temperatures, i.e. 1200 C, and negligible NO emissions throughout the cyclone chamber, in which complete burnout of fuel occurs. Refractory lining of the cyclone chamber is shown to improve performance by 40% with further increases possible by insulation of the inlet/outlet manifold and an increase in the strength of the annular recirculation zone. Comparison is made of the mean and fluctuating values of three components of velocity, measured by laser Doppler anemometry, for both isothermal and combustion conditions. (Author)

A80-19304 # Heat transfer including radiation and slag particles evolution in MHD channel. I. K. H. Im and R. K. Ahluwalia (Argonne National Laboratory, Argonne, Ill.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0250*. 13 p. 13 refs. Contract No. W-31-109-eng-38.

Accurate estimates of convective and radiative heat transfer in the magnetohydrodynamic channel are provided. Calculations performed for a base load-size channel indicate that heat transfer by gas radiation almost equals that by convection for smooth walls, and

amounts to 70% as much as the convective heat transfer for rough walls. Carbon dioxide, water vapor, and potassium atoms are the principal participating gases. The evolution of slag particles by homogeneous nucleation and condensation is also investigated. The particle-size spectrum so computed is later utilized to analyze the radiation enhancement by slag particles in the MHD diffuser. The impact of the slag particle spectrum on the selection of a workable design of an efficient seed collection system is discussed. (Author)

A80-19309 # Power take-off analysis for diagonally connected MHD channels. Y.-C. Pan and E. D. Doss (Argonne National Laboratory, Argonne, Ill.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0253*. 13 p. 16 refs. Contract No. W-31-109-eng-38.

The electrical loading of the power take-off region of diagonally connected MHD channels is investigated by a two-dimensional model. The study examines the loading schemes typical of those proposed for the U-25 and U-25 Bypass channels. The model is applicable for the following four cases: (1) connection with diodes only, (2) connection with diodes and equal resistors, (3) connection with diodes and variable resistances to obtain a given current distribution, and (4) connection with diodes and variable resistors under changing load. The analysis is applicable for the power take-off regions of single or multiple-output systems. The general behaviors of the current and the potential distributions in all four cases are discussed. The analytical results are in good agreement with the experimental data. It is found possible to design the electrical circuit of the channel in the take-off region so as to achieve a fairly even load current output under changing total load current. (Author)

A80-19310 * # Effect of off-design operation of MHD generators on NO_x/ chemical kinetics. G. A. Simmons and D. R. Wilson (Texas, University, Arlington, Tex.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0254*. 11 p. 27 refs. Grant No. NSG-3255.

The purpose of this study is to provide a capability for determining the chemical kinetic behavior of one family of pollutants, the nitrogen oxides, in the flow of a coal-fired MHD generator facility. The method used in the study allows the prediction of the nonequilibrium concentration of the minor NO_x(x) species in a flow otherwise assumed in equilibrium. Consideration is given to the effect of preheat, stoichiometry, and oxygen enrichment of the NO_x(x) concentration. The effect of preheat and stoichiometry is found to have a significant influence on the NO_x(x) concentration at the exit of the radiant boiler. V.T.

A80-19311 # Mach 3 hydrogen external/base burning. D. H. Neale, Sr., J. E. Hubbart, and W. C. Strahle (Georgia Institute of Technology, Atlanta, Ga.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0280*. 9 p.

Experimental studies of base pressure manipulation for an axisymmetric model at Mach 3 with simulated and actual external/base burning are described. Early work using contoured test section walls and cold gas base region injection is reviewed to demonstrate wake detail and length scale changes under the influence of simulated external/base burning. Tests with actual combustion of radially and axially injected hydrogen are then reported. Outstanding performance values with significant base drag reduction is shown for injection and burning directly in the near-wake (base burning). Current attempts at radial injection and burning in the free stream (external burning) have not yet succeeded. These tests, however, have defined an envelope within which external burning, if feasible, will presently be achieved. (Author)

A80-19326 # Solar concentrators using vacuum-contoured surfaces for tracking. W. Alexander and J. R. Howell (Texas, University, Austin, Tex.). *American Institute of Aeronautics and*

Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0399. 10 p. 8 refs.

The paper presents an analysis of solar concentrators using vacuum-contoured trough collectors for tracking. The analysis considers (1) the predicted radius of a flexible membrane subjected to a constant pressure differential, (2) methods of approximating a parabola with these circular shapes, (3) a computer program implementation, and (4) the nonideal effects which affect the mirror performance. It is shown that concentration ratios from 31 to 16 are obtained for incidence angles varying from normal to the trough to plus or minus 40 deg from normal at solar noon for two-segment collectors. Experimental results showing reflected beam profiles from the collector onto an absorber tube for trough collectors with f-numbers of 1.16 and 1.32 are presented and compared with predictions. A.T.

A80-19327 # A study of the solar LiBr dual cycle characteristics. H. Sofrata, A. Nasser, A. Shibli, and M. Megahed (Riyadh, University, Riyadh, Saudi Arabia). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0400*. 7 p. 8 refs.

In arid zones the Li-Br dual cycle may be used in air-conditioning. It has the advantage of avoiding the use of cooling tower. It, also, has the advantage of being powered by solar energy. A computer programme has been developed during this course of research in order to design this dual cycle, fulfilling all its temperature constraints and heat balance equations. The characteristics of the dual cycle has also been studied at different environmental conditions. The output results of the computer programme may be displayed on a cathodic ray tube or stored in a field and presented graphically. This facilitates a complete vision and study of the precalculated results. (Author)

A80-19328 # Solar-thermal jet pumping for irrigation. L. D. Clements, P. A. Dellenback, and C. A. Bell (Texas Tech University, Lubbock, Tex.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0402*. 6 p. 9 refs. Research supported by Texas Tech University.

This paper describes a novel concept in solar powered irrigation pumping, gives measured performance data for the pump unit, and projected system performance. The solar-thermal jet pumping concept is centered around a conventional jet eductor pump which is commercially available at low cost. The jet eductor pump is powered by moderate temperature, moderate pressure Refrigerant-113 vapor supplied by a concentrating solar collector field. The R-113 vapor is direct condensed by the produced water and the two fluids are separated at the surface. The water goes on to use and the R-113 is repressurized and returned to the solar field. The key issue in the solar-thermal jet eductor concept is the efficiency of pump operation. Performance data from a small scale experimental unit which utilizes an electrically heated boiler in place of the solar field is presented. The solar-thermal jet eductor concept is compared with other solar irrigation concepts and optimal application situations are identified. Though having lower efficiencies than existing Rankine cycle solar-thermal irrigation systems, the mechanical and operational simplicity of this concept make it competitive with other solar powered irrigation schemes. (Author)

A80-19421 The calculation of carbon load and axial profiles of oxygen concentration in the bed of a fluidized combustor. G. Donsi, L. Massimilla, M. Miccio, G. Russo, and P. Steconi (CNR, Laboratorio di Ricerche sulla Combustione; Napoli, Università, Naples, Italy). *Combustion Science and Technology*, vol. 21, no. 1-2, 1979, p. 25-33. 23 refs.

A80-19471 Under ground thermal storage in the operation of solar ponds. A. Akbarzadeh and G. Ahmadi (Shiraz University, Shiraz, Iran). *Energy (UK)*, vol. 4, Dec. 1979, p. 1119-1125. 14 refs. Research supported by the Ministry of Science and Higher Education of Iran.

The thermal interaction between a large solar pond and the surrounding ground is considered. For a given sinusoidal variation of the temperature at the bottom of the pond, the time-dependent temperature profiles in the ground are calculated and the corresponding heat fluxes to or from the ground as functions of time are obtained. The temperature variations in the ground for several years are plotted and the heat transfer between the solar pond and the ground thermal storage is discussed. The efficiency of heat recovery is studied and its significance is pointed out. (Author)

A80-19472 **Solar enhanced oil recovery - An assessment of economic feasibility.** K. D. Bergeron (Sandia Laboratories, Albuquerque, N. Mex.). *Energy* (UK), vol. 24, Dec. 1979, p. 1127-1137. 15 refs.

There are several qualitative reasons why steam enhanced oil recovery (EOR) appears to be well suited to solar energy use. These include favorable characteristics with regard to energy utilization, land availability, energy form, and geographical location. A number of technical questions require further research before the characteristics of solar enhanced oil recovery (SEOR) can be precisely specified or optimum systems designed. However, a cost model based on a number of working assumptions indicates competitiveness with conventional fuel-burning EOR systems at crude prices and solar collector system costs which can be reasonably expected to occur in the near future; e.g., for a nominal parameter set, including a solar energy system cost of \$200/sq m, the breakeven crude oil price is \$11.90/bbl.). (Author)

A80-19473 **Hydrogen and oxygen from water. II - Some considerations in the reduction of the idea to practice.** R. B. Diver and E. A. Fletcher (Minnesota, University, Minneapolis, Minn.). *Energy* (UK), vol. 4, Dec. 1979, p. 1139-1150. 10 refs. Contract No. ER-78-S-02-4737.

An analytical model of a one-step thermochemical process for producing hydrogen and oxygen from water by solar energy is constructed to evaluate sources of inefficiency and their dependence on operating variables and system configuration. The process is based on effusional separation in the Knudsen flow regime. The model includes: solar collector, reactor-separator, heat recovery systems, and cooler and pumps. It was shown that irreversibility in the reactor-separator is small and essentially independent of the hydrogen demand and that the greatest losses occurred in heat exchangers. In practice, the cost of the hydrogen produced is more important than an arbitrarily defined system efficiency. The use of heat from the high temperature heat exchanger to drive a heat engine for operating pumps and the replacement of the heat pump by a low temperature solar collector might substantially improve the economy of the process. V.L.

A80-19474 **Prospects for the near-term commercialization of shale oil in the United States.** G. Marland (Oak Ridge Associated Universities, Inc., Oak Ridge, Tenn.). *Energy* (UK), vol. 4, Dec. 1979, p. 1161-1174. 38 refs. Research supported by the Exxon Research and Engineering Co.; Contract No. EY-76-C-05-0033.

Political, economic and environmental aspects of commercial exploitation of shale oil resources in the United States are discussed. The identified resources of the highest grade shale oil in the U.S. are estimated at more than 400 billion barrels and it is certain that oil can be produced with the energy yield greater than the energy investment. However, the cost of the oil and the environmental impact of its production are not known. Three bills providing economic incentives for the development of a shale oil industry have been introduced in the U.S. Congress and a \$3 per barrel tax credit is debated. Differences exist over the incentives and the environmental issues, such as air and water quality impacts, water supply problems, and solid waste disposal. These problems and financial risks involved impede the commercialization of shale oil. V.L.

A80-19581 **Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volumes 1 & 2.** Symposium sponsored by EURATOM, CNR, Banca Cattolica del

Veneto, Cassa di Risparmio di Padova e Rovigo, and Istituto di Credito Fondiario, et al. Oxford and New York, Pergamon Press, 1979. Vol. 1, 633 p.; vol. 2, 500 p. Price of two volumes, \$178.50.

Papers are presented on the following subjects: the design of experimental fusion systems; fusion reactor system studies; plasma handling; power supplies; control of experimental systems and data processing; and toroidal magnet technology. Also considered are: tritium and blanket technology; vacuum and first wall technology; poloidal magnet systems; and large tokamaks. B.J.

A80-19585 **Testing and performance of the 30 kA ohmic heating system for ASDEX.** H. Wedler, J. Gernhardt, G. Klement, and E. v. Mark (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 43-48. 7 refs.

After installation of the 18 inner coils for the ohmic heating system (90 of 100 turns) of ASDEX the coils were successively run up to the full current strength of 30 kA. At the same time the radial and vertical motions of the individual OH coils and leads were systematically investigated with 60 displacement pickups. In a further test phase the tilt motion of the toroidal coils at the full toroidal field (45 kA, 28 kG) was measured. The results of these investigations are discussed in detail and an account is given of experience with the breaker system. (Author)

A80-19587 **A new high beta reversed field pinch machine.** P. D. Wilcock (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 55-60. 5 refs.

The HBTX1A experiment is a toroidal reversed field pinch with a metal bellows vacuum vessel of major/minor radii of 802/259 mm, supported within a close-fitting aluminum stabilizing shell, with no external guard vacuum. A 1 volt second iron core is used on the experiment. The machine is currently under construction and will be powered primarily by a rearrangement of the capacitor banks of the HBTX1 machine. This paper lists the main parameters, describes the general layout of the machine and discusses the areas of conflict and difficulty in the design. (Author)

A80-19589 **Numerical computations in the design of compact ignition experiments.** G. Cenacchi, A. Taroni (Comitato Nazionale per l'Energia Nucleare, Centro di Calcolo, Bologna, Italy), and B. Coppi (MIT, Cambridge, Mass.). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 77-82. 7 refs.

A series of interconnected physical and engineering problems have been solved numerically for the analysis of compact devices designed to produce and confine D-T plasmas in regimes where the alpha-particle heating is important. Codes have been developed and used for the following problems: plasma transport processes and heating cycles; ideal MHD equilibrium configurations; design of the equilibrium field and of the air core transformer systems; evaluation of the current density, magnetic field and temperature distribution in the toroidal magnet; stress distribution in the toroidal magnet. Results of the computations are presented. (Author)

A80-19592 **Poloidal magnetic field design of a pulsed tokamak reactor.** W. R. Spears (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 115-120. 9 refs.

This report considers the poloidal magnetic field design of a pulsed tokamak reactor with an air-cored transformer. Vertical field coil configurations are obtained for nominal plasma parameters by a Fourier analysis technique. The primary current configuration is calculated on the assumption that it creates zero field in the plasma region. After some general conclusions on conductor location have been reached, they are applied to the design of a 600 MWe reactor with noncircular plasma cross section and beta approximately equal to 8%. (Author)

A80-19593 Optimization of stabilized imploding liner fusion reactors. P. J. Turchi, D. L. Book (U.S. Navy, Naval Research Laboratory, Washington, D.C.), and R. L. Burton (JAYCOR, Alexandria, Va.). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 121-125. 16 refs. Research supported by the U.S. Department of Energy and U.S. Navy.

In the NRL LINUS concept for controlled fusion systems, a rotating liquid metal cylinder or liner is imploded onto a trapped plasma/magnetic field payload to obtain fusion temperatures and near-megagauss magnetic field levels by adiabatic compression. The combined use of liner rotation and a free-piston driving technique eliminates Rayleigh-Taylor instabilities and permits safe, repetitive implosion-reexpansion cycles. Optimization of system size is accomplished in terms of the implosion radius-ratio and liner compressibility. Trade-offs between reactor size and initial plasma temperature are indicated. (Author)

A80-19594 Influence of the scaling of plasma confinement on the economy and unit size of ignited toroidal reactors. G. Realini (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy) and F. Engelmann (EURATOM and Stichting voor Fundamenteel Onderzoek der Materie, Instituut voor Plasma-fysica, Jutphaas, Netherlands; EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro sui Gas Ionizzati, Frascati, Italy). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 127-132. 7 refs. Research supported by the Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek.

The importance of the scaling of energy confinement for reactor economy is discussed both qualitatively and quantitatively. For the latter, the neoclassical, trapped-ion Alcator and Huggill-Sheffield confinement models are considered. Confinement laws for which confinement impairs strongly with increasing temperature, are shown to be particularly favorable. In particular, trapped-ion scaling increases reactor economy by about a factor 2 with respect to the other models considered. Furthermore, at fixed wall loading, it permits units having a 3 to 4 times smaller power. (Author)

A80-19596 The effect of classical and anomalous transport on the performance of Tandem Mirror reactors. T. Kammash and D. L. Galbraith (Michigan, University, Ann Arbor, Mich.). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 141-146. 8 refs. Research supported by the U.S. Department of Energy and Electric Power Research Institute.

The particle and energy balance equations for a multispecies plasma in a Tandem Mirror reactor are solved numerically to assess the impact of cross field classical and anomalous transport on the Q-value of the reactor. It is shown that for commonly chosen values of magnetic fields and solenoid to plugs volume ratio Q values of 4-5 are attainable if the alpha particles are completely and selectively removed. It is also shown that these Q-values are significantly reduced when all the species in the central cell are allowed to undergo classical and/or anomalous diffusion across the confining magnetic field. (Author)

A80-19597 SISYFUS - A simulation model for systematic analyses of fusion power plants. K. Borrass, R. Buende, and W. Daenner (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 161-167. 7 refs. EURATOM-sponsored research.

The paper describes how the SISYFUS code, which simulates the performance of a fusion power plant as a function of time, is improved and extended. It is shown that as a first step a tokamak reactor was included and the useful plant output restricted to electricity. As a first application, the plant energy balance is used to calculate the influence of the accumulation of alpha particles and impurities, which is measured by differences in the plasma minor radius. Similarly, the influence of variations in beta, reactor idle time, and plant net power output is investigated. Finally, because of the trend towards very compact tokamak designs, assumptions and conditions are identified which yield a considerable reduction in size. (Author)

A80-19598 Doublet III neutral beam injection system overview and status report. M. M. Holland, E. W. Bailey, A. P. Colleraine, H. C. Courington, D. W. Doll, C. R. Harder, H. L. Horner, J. H. Kamperschroer, K. A. Koch, and J. C. Kohli (General Atomic Co., San Diego, Calif.). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 199-206. Contract No. CY-76-C-03-0167.

It is noted that the Doublet III tokamak is designed to operate initially with a toroidal magnetic field of 2.6 T, 5 V-sec of ohmic heating flux swing, a plasma current of 2 MA, and a plasma temperature of 1 keV. Attention is given to a plan to add two 80 keV hydrogen neutral beam injectors to produce about 3 keV temperatures utilizing about 7 MW of auxiliary beam heating. This will lead to the ultimate construction of a 20 MW, six injector system to produce reactor-grade plasmas in excess of 5 keV which will simulate breakeven conditions. The system and facility design is surveyed with emphasis on the cryogenic system and test facility. Finally, a brief discussion of the schedule and the status of construction and fabrication is also presented. (Author)

A80-19599 Measured and predicted beam attenuation in neutral beam drift ducts for tokamaks. J. H. Kamperschroer, A. P. Colleraine (General Atomic Co., San Diego, Calif.), and L. D. Stewart. In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 217-222. Contracts No. EY-76-C-03-0167; No. EY-76-C-02-3073.

Experimental evidence obtained with the Princeton Large Torus, PLT, neutral beam injectors at both the Oak Ridge National Laboratory and at Princeton has indicated that the transport of neutral beams through conductance limited drift ducts can induce exponentiating beam loss and subsequent beam blocking. Evidence indicates that beam loss on the drift duct wall causes thermally induced outgassing of absorbed hydrogen gas. Application of such a model will be shown to yield predictions which agree both in magnitude and time dependence with the observed results. (Author)

A80-19600 Design of antennae for R.F. power coupling to tokamak plasma in the ion cyclotron range of frequency. J. Adam, A. Darbandi, J. Jacquinot, and H. Kuus (EURATOM and Commissariat à l'Energie Atomique sur la Fusion, Département de Physique du Plasma et de la Fusion Contrôlée, Fontenay-aux-Roses, Hauts-de-Seine, France). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 263-267.

Additional heating of present day tokamak plasma in the ion cyclotron range of frequency requires coupling antennae located inside the vacuum chamber. Since the limiting factor in RF power transfer to the plasma is the voltage which can be supported by the antenna, efficient coupling calls for optimum current for a given RF supply voltage. Three antennae, designed for the TFR tokamak will be discussed. (Author)

A80-19608 **Design of antennae for R.F. power coupling to tokamak plasma in the ion cyclotron range of frequency.** J. Adam, A. Darbandi, J. Jacquinot, and H. Kuus (EURATOM and Commissariat à l'Energie Atomique sur la Fusion, Département de Physique du Plasma et de la Fusion Contrôlée, Fontenay-aux-Roses, Hauts-de-Seine, France). In: *Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1.* Oxford and New York, Pergamon Press, 1979, p. 263-267.

Additional heating of present day tokamak plasma in the ion cyclotron range of frequency requires coupling antennae located inside the vacuum chamber. Since the limiting factor in RF power transfer to the plasma is the voltage which can be supported by the antenna, efficient coupling calls for optimum current for a given RF supply voltage. Three antennae, designed for the TFR tokamak will be discussed. (Author)

A80-19611 Refueling by means of pellets - Ablation rate and injection velocity considerations. L. L. Lengyel and D. F. Duchs (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 283-288. 7 refs.

Pellet ablation rates computed with the help of different ablation models are compared. For investigating the response of the plasma to the injected pellet, the ablation models are combined with a multiregime tokamak transport code. The results indicate that the ionization dynamics of the ablated particles has a strong effect on the particle losses in divertor tokamaks: high pellet injection velocities may be required for compensating the substantial particle losses caused by supplying cold neutral particles to the plasma.

(Author)

A80-19612 MeV cluster ion beam diagnostics by means of calorimetry and time-of-flight spectroscopy. H. O. Moser (Karlsruhe, Kernforschungszentrum, Karlsruhe, West Germany), J. Martin, and R. Salin (Lyon, Institut de Physique Nucléaire, Lyons, France). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 289-294. 9 refs.

A system for the diagnostics of MeV cluster ion beams has been developed. It is based on time-of-flight mass spectrometry and calorimetric measurement of ion currents and allows for the measurement of the cluster ion mass spectrum and the ion and atom current profiles. The beam of the Lyon high-gradient cluster ion accelerator has been investigated. The results presented show mass spectra in the range of 1000-10,000 atoms per cluster. As a consequence of high-gradient acceleration the cluster ions exhibit a narrow kinetic energy spectrum. The minimum beam divergence is less than 1.2 deg. The atom currents and current densities lie in the range of 0.1-0.5 A and 0.2-1.0 A/sq cm, respectively, at a beam energy of 0.5 MeV per cluster ion and at a source-detector distance of about 1.9 m. The current densities exceed the space charge limit of a proton beam at the same kinetic energy and with the same beam geometry, by several orders of magnitude.

(Author)

A80-19617 150-kV, 80-A solid state power supply for neutral beam injection. H. Owren, W. Baker, D. Hopkins, and K. Milnes (California, University, Berkeley, Calif.). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 325-330.

A 150-kV, 80-A power supply and neutral beam test facility is now operational at the Lawrence Berkeley Laboratory, Berkeley, Calif. This supply uses banks of 450-V electrolytic capacitors for over one million joules of energy storage. SCR switches control the power flow to the neutral beam accelerator. Turn on and off times of a few microseconds are possible. An auxiliary capacitor bank also uses SCR switches to provide regulation ('flat-topping') of the main bank output by switching in additional capacitors as the main bank discharges. Air-operated switches are used to connect the main bank sections in parallel for charging and series or parallel for discharge, depending on the operating voltage desired.

(Author)

A80-19618 Construction and test of a high power injector of hydrogen cluster ions. E. W. Becker, H. D. Falter, O. F. Hagena, P. R. W. Henkes, R. Klingelhöfer, H. O. Moser, W. Obert, and I. Poth (Karlsruhe, Kernforschungszentrum, Karlsruhe, West Germany). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 331-337. 12 refs.

A high power injector of hydrogen cluster ions, rated for 1 MV and 100 kW, is described. The injector is split in three separate tanks connected by a 1 MV transfer line. The cluster ion beam source and all its auxiliary equipment is placed at high voltage, insulated by SF6 gas at a pressure of 4 bar. The main components of the injector are: The cluster ion beam source with integrated helium cryopumps, the CERN type acceleration tube with 750 mm i. d., the beam dump

designed to handle the mass and energy flux under dc conditions, a 1 MV high voltage terminal for the auxiliary equipment supplied by its 40 kVA power supply with power, and the 1 MV 120 kW dc high voltage generator. This injector is installed in Karlsruhe. Performance tests were carried out successfully. It is intended to use this injector for refueling experiments at the ASDEX tokamak.

(Author)

A80-19619 The application of computers to fusion experimental facilities. M. C. Crowley-Milling (Organisation Européenne pour la Recherche Nucléaire, Geneva, Switzerland). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 341-355.

The reasons for employing computers in control and data acquisition in fusion experimental facilities are discussed. Special requirements are examined when applying computers, interface equipment, software and other operator interfaces to fusion experiments. Some requirements that are mentioned are (1) the recording of maximum data amounts per shot, and (2) the archiving of data from previous shots with simple recall methods. Attention is given to various computer system layouts for fusion experiments including TEXTOR, TORUS II, and JET, and to the software and interface systems. The paper is concluded with a look at possible future developments such as towards simple and cheap devices that can be used to bring computing power into mass production with little cost increase.

C.F.W.

A80-19620 Electrical power system to TFTR poloidal coils. G. Karady, P. Bellomo, F. Petree (Ebasco Services, Inc., Princeton, N.J.), and R. Cassel (Princeton University, Princeton, N.J.). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 359-364. 6 refs. Contract No. EY-76-C-02-3093.

This paper describes the Tokamak Fusion Test Reactor Ohmic Heating (OH), Variable Curvature (VC), Equilibrium Field (EF) and Horizontal Field (HF) Systems. The system design consists of five OH coils, four EF coils, one VC coil, one HF coil and one shared EF-OH coil. Interlaced between OH coils are six 3 kV, 24 kA converters, shunted by an OH interrupter and coil overvoltage protection circuitry. Interlaced between EF coils are four 4 kV, 24 kA converters, a 3 MJ capacitor bank and coil overvoltage protection circuitry. The four 3 MJ capacitor banks are used for plasma compression. An interesting feature of the poloidal system is the application of switchgear which allows arrangement of the EF capacitor banks either for plasma compression during experimental operation or for aggressive discharge cleaning of the vacuum vessel.

(Author)

A80-19621 The combined d.c. power supply for JET. D. Ciscato (EURATOM and CNR, Abingdon, Oxon, England) and E. Coccorese (Calabria, Università, Abingdon, Oxon, England). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 365-370.

In view of the possibility that the Joint European Torus (JET) experiment could include a high energy pulse, a combined Power Supply scheme has been envisaged which makes use both of Flywheel-Generator-Convertors (FGC) and of the public network. The paper deals with the design of the new scheme, including two 400/33 kW step-down transformers, taking into account the limits on the reactive power and voltage drop at the 400 kV line. The analysis is performed through a comprehensive computer simulation program developed for this purpose. The results of the simulation and the final design with the rating of major equipment are given.

(Author)

A80-19624 Constant current and constant voltage excitation of large coils by flywheel-generator-converter. J. Kodaira, A. Miyahara, K. Matsuura (Nagoya University, Nagoya, Japan), K. Hirayama, S. Nohara, and Y. Hirata (Toshiba Corp., Fuchu, Japan).

In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 383-388.

The excitation of large dc coils by feedback to the exciter of the flywheel-generator-converter is an important problem regarding large fusion devices. This paper examines experimental data on the excitation of the toroidal and helical coils of the JIPP-T-2 tokamak-stellarator hybrid and the main solenoidal coils of the RFC-XX double cusped machine by a 100 MW flywheel-generator-converter. Results are presented on the direct-current and dc-voltage operation of these coils. B.J.

A80-19629 Ignitron switching problems associated with a large reversed field pinch experiment. P. M. Barnes, R. A. Burden, and J. W. Gray (EURATOM and U.K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 413-418.

The switching requirements for the main toroidal (I sub theta) and poloidal (I sub z) field systems for a large reversed field pinch (FRP) experiment are discussed. Both field systems are capacitor driven with a total start bank energy of 5MJ at 8kV. Circuit analysis is given showing the requirement for partial oscillatory discharge currents from the start banks and also the need for an extended clamping range outside the conventional second quadrant. In order to meet these requirements using ignitron switching it is necessary to connect the ignitrons in 'inverse-parallel' pairs. This allows commutation of the main current at current zero in order to prevent any excess reverse current flow through the ignitron, and also prevents the extinction of main current as it passes through zero at low values of di/dt. This 'inverse-parallel' connection also allows the clamping range to be extended over the full 360 degrees. Test results are included showing the commutation limitations of type E (BK 496) ignitrons when connected in an 'inverse-parallel' configuration. The di/dt limitations for oscillatory discharge currents in single ignitrons are also given. (Author)

A80-19655 Developments for the high voltage test of pulsed superconducting coils. A. Ulbricht, G. Nöther, and L. Siewerdt (Karlsruhe, Kernforschungszentrum, Karlsruhe, West Germany). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 1. Oxford and New York, Pergamon Press, 1979, p. 609-614. 9 refs. EURATOM-supported research.

The paper presents some experimental results obtained with an inductive power pulse generator of 40 MW switching power at 47 kV. A special bushing and a complete protection system of the pulse generator were developed and tested. Attention is given to an investigation of the voltage rise during the switching process as well as of the energy balance, which are then compared with calculated values. Finally, a cost estimate based on the results of the experiment is given for the application of a superconducting switch in an ohmic heating circuit for tokamaks. M.E.P.

A80-19657 Neutronics in the toroidal belt-geometry of a screw pinch reactor. K. A. Verschuur (Netherlands Energy Research Foundation, Petten, Netherlands). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 623-629. 8 refs.

The neutronics characteristics of the Belt Screw Pinch Reactor, which differ markedly from those for a tokamak reactor, are studied. Transport calculations have been performed in the toroidal belt geometry using albedos and accompanying absorption data for the blanket, which are calculated with one-dimensional Sn. For this purpose the ANISN code has been modified (ANISN-ALB), and the code FURNACE developed. The results for the BSPR show a marked poloidal variation of the neutron wall loading, the heating and the tritium production. The experiences with the codes ANISN-ALB and FURNACE are promising. (Author)

A80-19658 Blanket and power conversion system of NUWMAK. D.-K. Sze (Wisconsin, University, Madison, Wis.). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 631-637. 8 refs. Research supported by the U.S. Department of Energy and Wisconsin Electric Research Foundation.

A blanket design based on titanium structure, boiling water cooling, and using a phase change material as energy storage and tritium breeder is presented. This design is aimed to solve many problems associated with a tokamak reactor. In particular, thermal fatigue, thermal energy storage, tritium leakage problems are much alleviated. A respectable thermal efficiency is obtainable. Such a blanket and power conversion system should be simple, safe and reliable. (Author)

A80-19660 Diffusion of tritium in neutron-irradiated microcrystalline Beta-Li5AlO4. D. Guggi, H. R. Ihle, and U. Kurz (EURATOM and Kernforschungsanlage Jülich GmbH, Institut für Chemie, Jülich, West Germany). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 645-650. 6 refs.

A80-19662 Experimental studies of neutron multiplication from beryllium /n, 2n/ reaction in CTR blankets. T. K. Basu, P. Cloth, D. Filges, and V. R. Nargundkar (EURATOM and Kernforschungsanlage Jülich GmbH, Institut für Reaktorentwicklung, Jülich, West Germany). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 657-660. 6 refs.

A80-19663 Some implications of a cellular structure in minimum thickness fusion reactor blankets. L. J. Baker (Atomic Energy Research Establishment, Harwell, Oxon, England). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 661-666. 7 refs.

Some results are presented of survey neutron and photon transport calculations aimed at minimizing the thickness of fusion reactor blankets. It is demonstrated that a 3 zone helium cooled model may be chosen to yield a blanket employing an 0.2 m thick breeding zone. The transport calculations are of an idealized representation in that they ignore the inevitable subdivision of the blanket into cells for practical manufacturing and maintenance reasons. Monte Carlo calculations are described in which the implications of this are investigated. Parameters explored include the tritium breeding rates and the local increases in neutron flux and radiation damage at the rear of the blanket due to inter-cell streaming. (Author)

A80-19664 Possible improvements to a basic cellular thin blanket fusion reactor configuration. G. Constantine (Atomic Energy Research Establishment, Harwell, Oxon, England). In: Fusion technology 1978; Proceedings of the Tenth Symposium, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 667-672. 7 refs.

In a companion paper the implications of subdividing a thin fusion reactor blanket into discrete cells have been explored with particular reference to neutron streaming through the intercell spaces and the accompanying reduction in tritium breeding. A possible solution to both these problems is to fill these spaces with canned graphite blocks. Monte Carlo calculations are presented which demonstrate the effect of these graphite 'infillers' on the neutron economy of the blanket. Estimates are made of the nuclear heating of the infillers and the peak temperatures attained if cooling takes place only by radiative heat transfer to the cells and first wall. (Author)

A80-19665 Two-dimensional heating analysis of fusion blankets for synfuel production. O. W. Lazareth, J. S. K. Tsang, and J. R. Powell (Brookhaven National Laboratory, Upton, N.Y.). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 673-678. Research sponsored by the U.S. Department of Energy.

Fusion reactors could be used to generate electric power and produce synthetic fuels with relatively high efficiencies (about 60%). A two temperature zone blanket coupled to a high temperature electrolysis system would be used. An important parameter in this system is the ratio of the fusion neutron kerma energy absorbed by the hot interior (the higher temperature zone) to the total energy/fusion. This parameter is calculated as approximately 0.5 for both a one and two-dimensional model of the blanket module, and is a reasonable value for efficient energy production. (Author)

A80-19668 A system for the control of tritium losses in primary and steam circuits of a fusion power plant. F. Lanza, P. Rocco, and F. van Rutten (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerca, Ispra, Italy). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 691-695. 10 refs.

An analysis of the tritium pathway in the cooling system of a tokamak power reactor (FINTOR-D) shows the important role played by water impurities in the helium circuit. A dehydration system is described and the consequences on the tritium content in the cooling system are discussed. (Author)

A80-19669 Investigations of isotope separation effects of a Ti-fluidized bed. H. Weichselgartner and J. Perchermeier (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 697-702. 8 refs.

Experimental data on separation effects by hydrogen isotopes of a Ti-fluidized bed are presented. Desorption measurements of H₂ and D₂ on solid samples (foils, wires, bulk material and Ti solid bed getters) are discussed in terms of diffusion processes and compared with the fluidized bed results. The isotopic separation behavior of a fluidized bed in order to separate T₂ from other hydrogen isotopes in fusion devices is evaluated. A proposal is made how a fluidized bed must be designed of meeting specific needs of fusion devices.

(Author)

A80-19670 Main power supplies for large toroidal fusion experiments. E. Bertolini. In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 705-728. 23 refs.

The paper examines main power supplies for large toroidal fusion experiments. The tokamak loads, the toroidal magnetic field coils, the poloidal magnetic field system coils, and the plasma positioning system are discussed; in addition, energy storage by rotating machinery and by a static system are considered. The main power supplies for tokamaks use conventional synchronous alternators; however, since the operational duty is not conventional it is suggested that the power supply design be reassessed by examining Local Energy Storage, Flywheel-Generator-Converter (FGC), and Transformer Controlled Converter (TCC) equipment. In FGC units the generator is mechanically coupled to a motor driver and to a high inertia rotor to store the energy; the TCC units have been considered for the large tokamaks with powers exceeding 500 MW. A.T.

A80-19672 Behavior of SORB-AC wafer pumps in contaminated H₂ plasmas and during maintenance of plasma machines. B. Ferrario and L. Rosai (SAES Getters S.p.A., Milan, Italy). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 737-744. 9 refs.

A80-19676 The design of a thin walled toroidal vacuum chamber for a large RFP experiment. K. E. Lavender, H. J. Crawley, J. E. Partridge, and S. Skellett (EURATOM and U. K. Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, England). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 771-775.

A80-19682 Spatial and depth distribution of deuterium, oxygen, and limiter materials on the liner of TFR 400. B. M. U. Scherzer, R. Behrisch, H. Schmidl (EURATOM and Max-Planck-Institut für Plasmaphysik, Garching, West Germany), and R. S. Blewer. In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 809-814. 7 refs.

The coverage of the liner of TFR 400 with B, C, O, Mo and W and the areal density of trapped deuterium have been measured on about 50 samples cut from the liner after shutdown. Spatial distributions around the outer periphery and around 4 small cross sections are reported. A very close correlation is found for the Mo-deposit and the trapped deuterium. Depth profiles measured by proton elastic scattering (PES) and D(He-3, He-4)H nuclear reaction show the same correlation. This behavior indicates that trapped deuterium is covered by fresh limiter material so that the greater part of trapped gas does not participate in the recycling process. (Author)

A80-19708 Status of the JET project. P. H. Rebut (EURATOM and Commissariat à l'Energie Atomique, Abingdon, Oxon., England). (*International Atomic Energy Agency, Technical Committee Meeting on Large Tokamak Experiments, Paris, France, Sept. 1-6, 1978.*) In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 1035-1048.

With regard to the JET project, the physics of the plasma is discussed in terms of a high beta (of 5-10 percent) plasma in equilibrium, reducing the plasma impurity level, and RF heating, particularly by magnetic pumping, and ion cyclotron and hybrid ion-ion resonance heating methods. Machine systems considered are first: a double wall inconel vacuum vessel utilizing a metal bakeable gate valve which is the vacuum vessel/neutral injector interface; and second, magnetic systems including toroidal field coils and the poloidal field system. Two identical flywheel generator convertor systems constitute the power supply system, each made up of a vertical shaft generator, motor drive, static excitation unit and diode convertor unit, and each capable of delivering 2.6 GJ/pulse (30 s every 10 minutes), and peak power of 400 MW. In addition, a temperature-controlled recirculatory ventilation system is employed. The torus hall is maintained at an underpressure 7 mbar below atmospheric, while the intermediate hall is maintained at 5 mbar below atmospheric. J.P.B.

A80-19709 JT-60 project. M. Yoshikawa (Japan Atomic Energy Research Institute, Tokai, Ibaraki, Japan). In: *Fusion technology 1978; Proceedings of the Tenth Symposium*, Padua, Italy, September 4-9, 1978. Volume 2. Oxford and New York, Pergamon Press, 1979, p. 1079-1083.

The status and design of the Japanese JT-60 tokamak are reported. Scaling studies on JT-60, a large tokamak for the production of reactor-grade plasmas and the investigation of their physical and technical aspects relative to fusion reactor development, were begun in about 1970, with formal initiation of the JT-60 Program in 1973. After the conceptual design, preliminary design, engineering development and preconstruction design phases, the construction of the device was started in April, 1978 and is expected to be completed in 1983. The tokamak is designed for non-DT studies at temperatures up to 10 keV and confinement times up to 1 sec with a long discharge duration. The device features a removable

magnetic limiter for the control of current distribution and impurity content, a molybdenum liner, copper-based toroidal field coils with poloidal field coils inside them, and plasma heating by neutral beam injection at 75-keV and 20 MW and lower hybrid resonance heating at 10 MW; diagnostics are made along horizontal and vertical view lines and at an angle of 40 deg with the median plane. A.L.W.

A80-19716 # Studies on carbon dioxide cycles for power generation. I - Fundamental condensation cycles. K. Akagawa, T. Fujii, T. Sakaguchi (Kobe University, Kobe, Japan), and M. Aota (Kinki Industry Co., Japan). *JSME, Bulletin*, vol. 22, Nov. 1979, p. 1595-1603. 12 refs.

Further improvements in thermal efficiency of steam and nuclear power plants are an important problem in the present energy crisis. This report presents the performance characteristics of two fundamental condensation cycles employing carbon dioxide as a working medium. The effects of cycle parameters on thermal efficiency in non-reheat and reheat condensation cycles and values of optimum reheat pressures are discussed. Furthermore, losses in each component in different CO₂ cycles by utilizing the energy concept based on the second law of thermodynamics were analyzed and the effects of regenerating on irreversible losses were discussed. As the result, it was shown that at turbine inlet pressure of about 250 ata and turbine inlet temperatures higher than 650 C CO₂ condensation cycles in double- or triple-reheating give a better performance than conventional steam power-plant cycles. (Author)

A80-19740 Improved planar solar convertor based on uranyl neodymium and holmium glasses. R. Reisfeld and Y. Kalisky (Jerusalem, Hebrew University, Jerusalem, Israel). *Nature*, vol. 283, Jan. 17, 1980, p. 281, 282. 7 refs.

The energy transfer between uranyl ions (UO₂²⁺) and neodymium and holmium ions at concentrations suitable for use as glass dopants is calculated in order to evaluate the possibility of using uranyl-neodymium and uranyl-holmium codoped glasses in solar energy collectors. It is shown that, due to energy transfer from UO₂²⁺ to Nd³⁺, the integrated fluorescence intensity of the 1.06-micron transition of Nd³⁺ excited in the spectral range 360 to 500 nm is increased by a factor of 8.5, which corresponds to an increase of 150% over that of neodymium-only-doped glass excited in the range 360 to 800 nm. For excitation into the maximum absorption peak of UO₂²⁺ near 420 nm, emission spectra of Nd³⁺ and Ho³⁺ glasses codoped with UO₂²⁺ indicate that collector efficiency can be improved by the utilization of energy transfer from uranyl ions, which absorb strongly in the solar spectrum, to Nd³⁺, which emits in bands matching the maximum sensitivity of solar cells, however the application of Ho³⁺-codoped glasses may not be practical due to low branching ratios in holmium transitions. A.L.W.

A80-19844 Solar cells in practice (Solarzellen in der Praxis). H. Rechberger (ATEC Electronic GmbH, Munich, West Germany). *Elektronik*, vol. 29, Jan. 10, 1980, p. 72-78. 10 refs. In German.

The paper presents an overview of solar energy, its various types and its uses as an alternate energy source. Attention is given to the characteristic curves of solar cells that are determined by temperature, series resistance, and shunt resistance. The development, construction types, assembly, circuitry and dimensioning of solar cells are discussed in detail. The use of solar generators as an application where no power-supply voltage exists is also discussed. C.F.W.

A80-19847 # Relativistic high-current microwave plasma electronics (Relativistskaia sil'notochnaia SVCh plazmennaiia elektronika). L. S. Bogdankevich, M. S. Rabinovich, and A. A. Rukhadze (Akademia Nauk SSSR, Fizicheskii Institut, Moscow, USSR). *Fizika*, vol. 22, no. 10, 1979, p. 47-58. 21 refs. In Russian.

This review examines advances in the field of relativistic microwave plasma electronics associated with the utilization of high-current electron beams. Attention is given to classical (non-quantum) electronics and to the exploitation of the following

radiation mechanisms: (1) transition radiation, (2) bremsstrahlung, (3) cyclotron radiation, (4) Cerenkov radiation, and (5) the Compton effect. The utilization of such effects in TWTs, BWTs, and magnetrons is discussed. B.J.

A80-19955 Cavity enhancement by controlled directional scattering. R. Winston (Chicago, University, Chicago, Ill.). *Applied Optics*, vol. 19, Jan. 15, 1980, p. 195-197. 10 refs.

A method for designing cavity enclosures is presented that can be applied to the design of a nonimaging concentrator. The method maintains high transmission at the expense of some concentration in the presence of a gap between the reflector and the receiver. The slight loss of concentration may be partly offset by enhanced absorption of radiation by the receiver, resulting from the cavity effect. C.F.W.

A80-19976 New concept for a system suitable for solar simulation. I. Powell (National Research Council, Ottawa, Canada). *Applied Optics*, vol. 19, Jan. 15, 1980, p. 329-334. 8 refs.

A theoretical study of a new approach for a solar simulator design capable of testing solar collectors is described. The technique involved in this design requires that the source have rotational symmetry and employs a 2-D approach in the calculation of the irradiance in the image plane. Reflecting surfaces to be used with two different types of light source are computed to illustrate practical applications of this method. (Author)

A80-19989 # Open cycle air turbine solar thermal power system (Générateur solaire a turbine a air fonctionnant en cycle ouvert). E. Le Grivès (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *La Recherche Aérospatiale*, Nov.-Dec. 1979, p. 355-373. 9 refs. In French.

Solar electrical power generation using a heated air turbine in conjunction with a tower-mounted central receiver and heliostat field can be hybrid fossil fuel fired so as to avoid thermal storage problems. Using a regenerative gas turbine open cycle, no cooling system is required. It is shown that with a solar receiver concept allowing a fast thermal response to transient radiation situations, a turbine inlet temperature of 1100 to 1150 K can be reached with an overall efficiency (power available on turbine shaft/power radiated into receiver) of 25 percent, with a 2000 sun concentration ratio. Solar receiver, turbocompressor and regenerator sizes are given for a thermal power input of 1 MW into the receiver. (Author)

A80-20058 # Digital computer modeling of steady-state conditions of the magnetoplasma dynamic generator current layer (Modelirovanie na TSVM ustanovivshegosia rezhima tokovogo sloia magnetoplazmodinamicheskogo generatora). N. V. Markovskii and G. L. Baranov (Akademiia Nauk Ukrainskoi SSR, Institut Elektrodinamiki, Kiev, Ukrainian SSR). *Problemy Tekhnicheskoi Elektrodinamiki*, no. 69, 1979, p. 34-40. 14 refs. In Russian.

The paper examines a physical model of the high-temperature current layer which interacts with magnetoplasma dynamic generator duct walls. A mathematical model using nonlinear differential equations which depict this process is utilized, and the results of digital computer computations conforming to a block-diagram of this model for various operating conditions are presented. A.T.

A80-20066 # Investigation of the effect of piston induction on energetic characteristics of a piston linear generator with a ferromagnetic core (Issledovanie vliianiia induktivnosti porshnia na energeticheskie kharakteristiki porshnevoogo lineinogo generatora s ferromagnitnym serdechnikom). S. S. Pignastii (Akademiia Nauk Ukrainskoi SSR, Institut Elektrodinamiki, Kiev, Ukrainian SSR). *Problemy Tekhnicheskoi Elektrodinamiki*, no. 69, 1979, p. 109-114. 5 refs. In Russian.

A80-20069 # Change in rate of conducting-piston motion and the characteristics of field-diffusion processes in a linear electromechanical energy converter (Izmenenie skorosti dvizheniia provodiashchego porshnia i osobennosti protsessov diffuzii polia v

lineinom elektromekhanicheskomo preobrazovatele energii). V. T. Chemeris and S. A. Gavrilko (Akademiia Nauk Ukrainskoi SSR, Institut Elektrodinamiki, Kiev, Ukrainian SSR). *Problemy Tekhnicheskoi Elektrodinamiki*, no. 70, 1979, p. 94-99. In Russian.

A80-20128 * Space applications of superconductivity - High field magnets. F. R. Fickett (National Bureau of Standards, Thermophysical Properties Div., Boulder, Colo.). *Cryogenics*, vol. 19, Dec. 1979, p. 691-701. 20 refs. NASA Order A-437018.

The paper discusses developments in superconducting magnets and their applications in space technology. Superconducting magnets are characterized by high fields (to 15T and higher) and high current densities combined with low mass and small size. The superconducting materials and coil design are being improved and new high-strength composites are being used for magnet structural components. Such problems as maintaining low cooling temperatures (near 4 K) for long periods of time and degradation of existing high-field superconductors at low strain levels can be remedied by research and engineering. Some of the proposed space applications of superconducting magnets include: cosmic ray analysis with magnetic spectrometers, energy storage and conversion, energy generation by magnetohydrodynamic and thermonuclear fusion techniques, and propulsion. Several operational superconducting magnet systems are detailed. V.L.

A80-20141 Use of nuclear techniques in the characterization of chrome black solar absorber surfaces. Z. E. Switkowski (Kodak Australasia Pty., Ltd., Coburg, Victoria, Australia), J. C. P. Heggie (Melbourne, University, Melbourne; St. Vincent's Hospital, Fitzroy, Victoria, Australia), G. J. Clark (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, North Ryde, New South Wales, Australia), and R. J. Petty (Alfred Hospital, Prahran, Victoria, Australia). *Australian Journal of Physics*, vol. 32, Sept. 1979, p. 343-360. 36 refs.

A set of electrodeposited chrome black solar absorbers has been subjected to ion beam analysis in an attempt to determine the concentration depth profiles of the major elemental constituents. Chromium distributions were obtained using the Cr-52(p, gamma) Mn-53 nuclear reaction, which is resonant at $E_p = 1005.2$ keV. The possibility was investigated of inferring oxygen distributions from the gamma-ray lineshapes (measured with a Ge(Li) detector) of the direct capture reaction O-16(p, gamma)F-17. Concentration profiles were also obtained for fluorine and sodium contaminants in some chrome blacks. Complete experimental details are given of the various nuclear techniques used. The results of these measurements are discussed in terms of the microscopic physical features of the selective surfaces and are related to the known photochemical properties of the surfaces. (Author)

A80-20157 Steady-state currents driven by collisionally damped lower-hybrid waves. R. McWilliams, E. J. Valeo, R. W. Motley, W. M. Hooke, and L. Olson (Princeton University, Princeton, N.J.). *Physical Review Letters*, vol. 44, Jan. 28, 1980, p. 245-248. 24 refs. Contract No. EY-76-C-02-3073.

Experiments demonstrating the transfer of momentum from lower-hybrid (electron plasma) waves to electron currents, which offer a plausible alternative to pulsed Ohmic heating currents in tokamaks, by means of collisional absorption are reported. Lower-hybrid waves were excited by bursts of 60 to 70-MHz fields applied to phased loops mounted on the outside of a fused quartz tube surrounding a linear helium, neon or argon afterglow plasma, and the current was studied as a function of input power. It is found that lower-hybrid waves can generate current densities on the order of a saturation density which is on the order of the toroidal currents required in tokamaks. The electron current obtained is observed to be roughly half that predicted by an approximate solution of an electron kinetic equation with a Lorentz collision operator, and possible reasons for this discrepancy are discussed. The wavelength dependence of the current predicted by the theory is, however, verified. A.L.W.

A80-20158 Effect of finite beta on drift-wave turbulence and particle confinement. A. Hasegawa (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), H. Okuda (Princeton University, Princeton, N.J.), and M. Wakatani (Kyoto University, Kyoto, Japan). *Physical Review Letters*, vol. 44, Jan. 28, 1980, p. 248-251. 11 refs. Research supported by the Yamada Foundation; Contract No. EY-76-C-02-3073.

Consideration is given to the effect of plasma beta on electric potential and diffusion in a toroidal plasma with magnetic shear. Mode-coupling equations are derived for a finite-beta plasma with magnetic shear which describe the coupling in finite-beta drift Alfvén wave turbulence. It is shown that when beta is greater than the square of the inverse aspect ratio, cross-magnetic-field diffusion is enhanced by the appearance of convective cells, while if beta is much less than the square of the inverse aspect ratio, the electric potential obeys the Hasegawa-Mima mode-coupling equation for electrostatic drift waves, reducing plasma diffusion. Results of numerical experiments are presented which confirm the theoretical results. A.L.W.

A80-20159 Study of current-driven magnetohydrodynamic instability in the Heliotron-D device. O. Motojima, A. Iiyoshi, and K. Uo (Kyoto University, Uji, Japan). *Physical Review Letters*, vol. 44, Jan. 28, 1980, p. 251-255. 15 refs.

The magnetohydrodynamic stability of the Ohmically heated plasma in the Heliotron-D device, which has a large external rotational transform and strong shear, is investigated. Magnetohydrodynamic activity was analyzed in a helium plasma in the Pfirsch-Schlüter regime as the Ohmic current was varied from 0.5 to 2 in a direction chosen to increase the rotational transform by an array of magnetic probes outside the plasma. Instabilities are found to occur in the regions where the sum of the Ohmic current and the external rotational transform is an integer, however, the Ohmic current can exceed the unstable regimes, resulting in stable discharges for an Ohmic current greater than unity. It is found that there is no Ohmic current flow outside the plasma, and the stabilizing effect of the magnetic shear on the predicted MHD instabilities is demonstrated. A.L.W.

A80-20165 A multi-pulse ruby laser recording of the temporal evolution of plasma parameters by light scattering. R. Behn (Stuttgart, Universität, Stuttgart, West Germany). *Physics Letters*, vol. 74A, Nov. 26, 1979, p. 316-318. 10 refs.

A repetitively Q-switched ruby laser employing a prototype system that uses six linear flashlamps, set up in a close-coupled configuration to pump a 5/8 in. by 6.5 in. ruby rod, is examined. The laser is capable of recording the temporal evolution of electron density and temperature of a tokamak-type plasma by Thomson scattering. Due to the repetition rates and the fact that inversion stays well below the level of single pulse operation, it is determined that the requirements concerning the contrast ratio of the optical switch can be reduced. It is shown that with a high density arc plasma a temporal resolution of 40 microsec has been achieved. C.F.W.

A80-20242 Residential heat loss mapping of Farmington, New Mexico using airborne thermal scanning. T. K. Budge and M. H. Inglis (New Mexico, University, Albuquerque, N. Mex.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 82-91. Research supported by the New Mexico Energy and Minerals Department and New Mexico Energy Institute.

A80-20274 Nonequilibrium thermodynamics of fuel cells - Heat release mechanisms and voltage. G. Wilemski (Physical Sciences, Inc., Woburn, Mass.). *Journal of Chemical Physics*, vol. 72, Jan. 1, 1980, p. 369-377. 10 refs. Research supported by the U.S. Department of Energy.

Nonequilibrium thermodynamics is used to analyze the spatial distribution of heat release mechanisms occurring in fuel cells operating under load in nonisothermal steady states. Novel contribu-

tions to heat release in the bulk electrolyte are found which are analogous to Peltier and Thomson effects in metallic conductors. Expressions for the heat release at individual electrodes are presented. An equation for the voltage of these cells is also derived.

(Author)

A80-20378 Analysis and simulated diagenesis of kerogen in a recent bottom mud from Mono Lake, California - A comparison with selected ancient kerogens. D. S. Sklarew (Arizona, University, Tucson, Ariz.). *Geochimica et Cosmochimica Acta*, vol. 43, Dec. 1979, p. 1949-1958. 40 refs. Grant No. NGR-03-002-171.

A80-20424 OTEC - Solar energy from the sea. R. H. Douglass, Jr. (TRW Defense and Space Systems Group, Systems Engineering and Integration Div., Redondo Beach, Calif.). *Quest*, vol. 3, Autumn 1979, p. 3-29.

The principles and history of ocean thermal energy conversion (OTEC) are discussed, along with U.S. and foreign OTEC programs, where all proposed OTEC plants use the Rankine cycle. Particular attention is given to OTEC components such as the mechanically durable 0.030 inch thick tube walls of the heat exchanger. The working fluid of modern closed cycle systems is ammonia, and mechanical cleaning and chlorination are used against biofouling. Heat exchanger types, including shell-and-tube, plate-fin, and trombone are considered, as well as the hull of the plant, its platform, sea water pumps, and differently designed cold water pipes. Moreover, computer models designed to study performance sensitivity to various operating parameters are discussed.

J.P.B.

A80-20453 The challenge of efficiently retorting very nonuniform beds of oil shale rubble. T. R. Galloway (California, University, Livermore, Calif.). *In Situ*, vol. 3, no. 4, 1979, p. 279-330. 55 refs. Contract No. W-7405-eng-48.

The paper reviews current analyses of the problem, together with experimental evidence for the key fluid-mechanical, heat-transfer, and mass-transfer processes that cause these lower yields. It is found that loss in retort oil yield is dominated by the flow patterns in the matrix material around the large blocks and by the thermal transient characteristics within the blocks. The principal mechanism appears to be burning and cracking of the produced oil in the gas phase near the larger shale blocks. The use of process-control methods involving air/steam ratio, total flow, and flow variations coupled with monitored exit-gas composition appears feasible to maximize oil production.

(Author)

A80-20454 Adsorption of hydrogen sulfide in shale retorted in an inert atmosphere. E. Pedram, M. A. Hasanain, A. L. Hines (Colorado School of Mines, Golden, Colo.), and J. J. Duval (U.S. Department of Energy, Laramie Energy Technology Center, Laramie, Wyo.). *In Situ*, vol. 3, no. 4, 1979, p. 331-352. 14 refs. Contract No. DE-AC20-79LC10020.

The recovery of oil from shale by in situ retorting eliminates mining a portion of the shale and the pollution problems related to the disposal of large quantities of spent shale. Spent shale beds offer a possible means of disposing of retort water and undesirable combustion gases. This study investigates the adsorption of hydrogen sulfide on oil shale retorted in nitrogen at temperatures from 250 to 950 C and the changes in the properties of shale during retorting. Chemical and X-ray diffraction analyses results indicate a strong influence of retorting on the properties of spent shale. Adsorption studies resulted in equilibrium isotherms modeled by the Langmuir, Freundlich, and Polanyi equations and the data for all temperatures showed good consistency. It is shown that while the use of spent shale beds as a means of disposing of undesirable retort gases appears feasible, a prediction as to the effectiveness of the retort zone as a disposal site would be premature.

V.L.

A80-20455 Mineral changes during oil shale retorting. W. C. Park, A. E. Lindemanis, and G. A. Raab (Occidental Research Corp., Irvine, Calif.). *In Situ*, vol. 3, no. 4, 1979, p. 353-381. 34 refs.

Most shale oil processes operate well above 400 C and the elevated temperatures also cause various inorganic reactions. The paper investigates the solid-state mineral reactions which occur under conditions encountered during in situ retorting. These reactions are important in modeling the retorting process and in selecting operating parameters to minimize the environmental impact of spent shale on ground water. To characterize the mineral assemblages and compositions in the retorted spent shale several methods are used, such as X-ray powder diffraction, optical microscopy of polished-thin sections, and electron microprobe analysis. Some of the conclusions made as a result of the study are: 1) for extended retorting at over 700 C all carbonates are converted to silicates; 2) the decomposition of the carbonate minerals to the free oxides is highly endothermic but enthalpy is reduced during silication; and 3) ground water leachability can be minimized by the formation of the silicate minerals at the high temperatures and long times utilized for in situ retorting.

V.L.

A80-20456 # OTEC - A comprehensive energy analysis. T. C. G. Carlson (Massachusetts, University, Amherst, Mass.). *Mechanical Engineering*, vol. 102, Jan. 1980, p. 32-39. 18 refs.

A comprehensive energy analysis is presented for a proposed Gulf-Stream-based Ocean Thermal Energy Conversion (OTEC) system designed to supply upon demand 148 billion kWh to New England by 1990. Basically, the system consists of one hundred and six 400-MW power plants, with factors of 0.93, generating hydrogen on-board which is transported by underwater pipe to deep-water storage or to terminals onshore for reconversion to electricity. The results of a net energy-input-output analysis show that the OTEC system compares favorably with other energy conversion systems: e.g. for the same net electric energy output it uses from 36 to 53 percent less fossil fuel than the two nuclear power plant systems used for comparison. A dynamic energy analysis indicates energy payoff times from 4.7 to 6.2 years and on-line times of 17 to 35 years.

V.L.

A80-20495 # Possibility of conversion of solar corpuscular radiation energy into electrical energy (O vozmozhnosti preobrazovaniia energii korpuskuliarnogo izlucheniia solntsa v elektricheskuui). S. Ibadov (Akademiia Nauk Tadzhikskoi SSR, Institut Astrofiziki, Dushanbe, Tadzhik SSR). *Akademiia Nauk Tadzhikskoi SSR, Doklady*, vol. 22, no. 7, 1979, p. 408-412. 12 refs. In Russian.

The paper considers the use of an electrical capacitor type device for the spaceborne conversion of corpuscular radiation energy from solar flares into electrical energy. Some calculations are presented for the case of such a device being located in interplanetary space or at the surface of a planet with a weak magnetosphere.

B.J.

A80-20499 The controlling production mechanism of methane gas from coalbeds. T. M. Doscher (Southern California, University, Los Angeles, Calif.), V. A. Kuuskraa, and E. Hammer-shaib (Lewin and Associates, Washington, D.C.). *Energy Sources*, vol. 5, no. 1, 1980, p. 71-84.

Characteristics of the production of methane from coal and physical mechanisms controlling the production are investigated. It is shown that the recovery of methane is determined by the interaction of two controlling factors: diffusion of methane from coal into the fracture system and permeability within the fracture system, with ultimate recovery depending upon the concentration of methane and the effective drainage volume of the wellbore. At low diffusion constants recovery is limited by diffusion and increasing production requires connecting large additional surface areas to the wellbore. At higher diffusion constants recovery is permeability-limited and can be improved by increasing the wellbore radius or the permeability.

V.L.

A80-20538 New approach for Vlasov equilibrium of a relativistic electron beam in a plasma medium. T. Saito (Soka University, Tokyo, Japan), T. Shimojo, and S. Goto (Tokyo Gakugei University, Tokyo, Japan). *Nuovo Cimento B, Serie 11*, vol. 53 B, Oct. 11, 1979, p. 301-310. 11 refs. Research supported by the Ministry of Education, Science and Culture of Japan.

The structure of an equilibrium, axially symmetric electron beam propagating in a plasma medium is studied in the framework of the relativistic Vlasov equations and the Maxwell equations. Instead of the usually adopted assumption that the neutralization fraction is independent of radial position, the more physical requirement that the energy of the electromagnetic fields produced by the particles takes its minimum value is proposed. The condition for the electron beam and plasma medium to be in equilibrium is expressed by a well-defined relation among the temperatures, the mean velocities and the neutralization fraction, and the Bennett distribution is obtained. (Author)

A80-20641 * **Weight optimization of ultra large space structures.** R. P. Reinert (Boeing Aerospace Co., Seattle, Wash.). *Society of Allied Weight Engineers, Annual Conference, 38th, New York, N.Y., May 7-9, 1979; Paper 1301.* 22 p. 5 refs. Contracts No. NAS9-15196; No. NAS9-15636.

The paper describes the optimization of a solar power satellite structure for minimum mass and system cost. The solar power satellite is an ultra large low frequency and lightly damped space structure; derivation of its structural design requirements required accommodation of gravity gradient torques which impose primary loads, life up to 100 years in the rigorous geosynchronous orbit radiation environment, and prevention of continuous wave motion in a solar array blanket suspended from a huge, lightly damped structure subject to periodic excitations. The satellite structural design required a parametric study of structural configurations and consideration of the fabrication and assembly techniques, which resulted in a final structure which met all requirements at a structural mass fraction of 10%. A.T.

A80-20643 **The satellite power system concept and program.** G. M. Hanley (Rockwell International Corp., El Segundo, Calif.). *Society of Allied Weight Engineers, Annual Conference, 38th, New York, N.Y., May 7-9, 1979, Paper 1305.* 14 p.

The paper summarizes the approaches that have been considered for the satellite power system (SPS) and the current reference concept defined by NASA and the Department of Energy (DOE). The overall system's characteristics are described. The NASA-DOE reference SPS system consists of two different satellite approaches, both of which utilize solar photovoltaic energy conversion and have 5-GW power outputs on the ground. One approach uses a silicon solar cell array without reflecting concentrators, while the other employs gallium arsenide solar cells in an array with flat concentrators. The approach to satellite construction and transportation system characteristics are also described. V.T.

A80-20686 # **Utilization of ocean heat for hydrogen production (Vikoristannia tepla okeanu dlia oderzhannia vodniu).** B. O. Troshen'kin. *Akademiia Nauk Ukrain's'koi RSR, Visnik*, vol. 43, Oct. 1979, p. 22-30. 16 refs. In Ukrainian.

Methods of obtaining electrical energy from the temperature difference of ocean layers are reviewed, along with recent progress in the field of electrolytic hydrogen generators. The selection of chemical energy carriers for ocean thermal energy delivery systems is discussed. V.P.

A80-20714 **Coatings for enhanced photothermal energy collection. II - Non-selective and energy control films.** C. M. Lampert (California, University, Berkeley, Calif.). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 1-17. 23 refs. Research supported by the U.S. Department of Energy.

Several types of coatings and surface preparations, other than selective absorbers, can be utilized for economical collection and control of solar energy. These films can be used for both solar thermal collectors and for window systems in buildings. Numerous nonselective, hot and cold mirror, and antireflective coatings are reviewed and tabulated. Detailed reflectance, emittance and thermal stability data are presented for these various coatings. Both moderately selective and nonselective absorbers consist of black paint, chemical conversion finishes, electroplated and anodized coatings.

Both hot and cold mirror coatings are selective transmitters of energy. They are considered for applications where light and heat need to be separated and trapped. Antireflective films are evaluated for use on glass surfaces. The findings of this study reveal many different types of inexpensive and promising coatings for efficient utilization of solar energy. (Author)

A80-20715 **The effect of fluorescent wavelength shifting on solar cell spectral response.** H. J. Hovel, R. T. Hodgson, and J. M. Woodall (IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y.). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 19-29. 7 refs.

Fluorescent wavelength shifting has been used to enhance the spectral response and AMO conversion efficiency of several types of solar cells. Plastic fluorescent materials are useful for devices with a sharp cut-off in response, while ruby is suitable for devices with more gradual cut-offs. Efficiency improvements of 0.5 to 2 percentage points were measured on some cells, and greater improvements can be expected for optimized optical components. The optical efficiencies exceeded 50% for the plastic sheets and 75% for ruby. (Author)

A80-20716 **Preparation and properties of Au-n/AlxGa1-xAs-n/GaAs Schottky barrier solar cells.** Y. D. Shen and G. L. Pearson (Stanford University, Stanford, Calif.). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 31-43. 9 refs. NSF Grant No. DMR-84373.

The paper derives a model for Au-n/AlxGa1-xAs-n/GaAs Schottky barrier solar cells. Theoretical analyses indicate that a cell of this type can be designed to have a short circuit current density of the same magnitude as that of an ordinary Au-GaAs Schottky barrier solar cell, while the open circuit voltage is greater and increases with Al composition x. Analysis shows that a Au-n/Al0.3Ga0.7As-n/GaAs Schottky barrier solar cell with an appropriate antireflection coating can be designed to have an open circuit voltage of 0.76, a short circuit current density of 30 mA/sq cm, a fill factor of 0.87 and a conversion efficiency of 19.5% when irradiated with an input power density of 100mW/sq cm. In addition, it is shown that, in order to have good collection efficiency of the photogenerated electron-hole pairs in the GaAs layer, the AlGaAs layer thickness must be less than 1000 Å. This result was confirmed by spectral response measurements. M.E.P.

A80-20717 **Measurements of minority-carrier diffusion length in heterojunction solar cells.** L. Tarricone (CNR, Gruppo Nazionale di Struttura della Materia, Parma, Italy) and E. Gombia (CNR, Parma, Italy). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 45-52. 11 refs.

The minority carrier diffusion length in the base material of Zn(x)Cd(1-x)S/GaAs solar cells have been investigated by measuring the open-circuit voltage as a function of the wavelength of the incident light. An extension of the surface photovoltage method to heterojunctions has been tried, determining the condition by which the open-circuit voltage or the short-circuit current is a linear function of the reciprocal absorption coefficient for each wavelength. The diffusion length values, obtained by extrapolation to zero light intensity of this linear function, are reported for several heterojunctions and compared to the growth processes and to the photovoltaic performances. (Author)

A80-20719 **Cobalt oxide as a spectrally selective material for use in solar collectors.** W. Kruidhof and M. van der Leij (Delft, Technische Hogeschool, Delft, Netherlands). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 69-79. 10 refs.

Cobalt oxide on bright nickel-electroplated steel was investigated for its use as a spectrally selective material in solar collectors. Cobalt was formed electrochemically in a high efficiency cobalt sulphate bath and oxidized in air at 400 °C. The bath pH-value had the greatest influence on the optical properties of the oxide with best results obtained at a pH of 2.3. Three types of cobalt oxide on bright nickel-plated steel, produced under optimal process conditions are

presented. The high absorptance found at pH = 2.3 is mainly due to the structure of the upper part of the surface, which is needle-like without and rod-like with an iron(3) sulphate addition. Heating tests at different temperatures in air and in vacuum showed that of the two coatings with a high solar absorptance, the one made with an iron(3) addition to the bath seemed to be stable up to 300 C.

(Author)

A80-20720 The spectral selectivity of conducting micro-meshes. D. Pramanik, A. J. Sievers, and R. H. Silsbee (Cornell University, Ithaca, N.Y.). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 81-91. 24 refs. NSF-supported research; Contract No. EG-77-S-03-1456.

The intrinsic absorption produced by the texture and finite conductivity of thin micromeshes is shown to severely limit their potential as a new class of heat mirrors. For semiconducting meshes it is shown that a 90% transmissivity in the solar spectral region is not compatible with a 90% reflectivity in the thermal re-radiation region; for metallic meshes only Al and Mg with submicron wire diameters show a potential improvement in selectivity over that obtained with thin metallic films.

(Author)

A80-20722 Stabilized CVD amorphous silicon for high temperature photothermal solar energy conversion. D. C. Booth, D. D. Allred, and B. O. Seraphin (Arizona, University, Tucson, Ariz.). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 107-124. 33 refs. Contract No. ER-78-S-02-4899.

By pyrolytic decomposition of silane in the presence of dopant gases, a set of amorphous silicon films was prepared that contains various concentrations of carbon, nitrogen, boron or germanium. The effect of these dopants on the crystallization process and the optical properties is investigated. Films containing about 18 at.% carbon show the properties most favorable for solar absorbers. The crystallization is retarded to temperatures near 1000 C, and the solar absorptance is greater than that of non-intentionally doped CVD amorphous silicon. From the experimentally determined activation energy of crystallization, the structural lifetime for such absorber films is extrapolated to be in excess of several decades for continuous operation at 700 C. For identical thicknesses of absorber layers, spectrally selective stacks of stabilized amorphous silicon deposited on top of a molybdenum reflector have higher solar absorptance than stacks composed of polycrystalline silicon on a silver reflector, amorphous silicon on molybdenum having been tested at temperatures in excess of 500 C.

(Author)

A80-20723 Schottky barrier height, photovoltage and photocurrent in liquid-junction solar cells. J. Gobrecht and H. Gerischer (Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Fritz-Haber-Institut, Berlin, West Germany). *Solar Energy Materials*, vol. 2, Sept.-Nov. 1979, p. 131-142. 24 refs.

The height of the Schottky barrier at a CdS electrode in contact with various redox electrolytes has been measured at electronic equilibrium and the open-circuit photovoltage was linearly related to this quantity at constant illumination intensity. The photocurrent-voltage curves of such redox electrolyte junctions with CdS, n-GaAs and n-MoSe₂ electrodes have been studied as a function of the light intensity which was varied over three orders of magnitude. The photocurrent of such electrochemical solar cells is at the open-circuit voltage compensated by the forward current through the junction, and its magnitude in comparison to the saturation current provides information on whether the recombination or the forward current controls the open circuit voltage of solar cells is discussed.

(Author)

A80-20727 Temperature dependence of open-circuit photovoltage of a back-surface field semiconductor junction. A. Sinha and S. K. Chattopadhyaya (Kurukshetra University, Kurukshetra, India). *Solid-State Electronics*, vol. 22, Oct. 1979, p. 849-852. 15 refs. Research supported by the Department of Atomic Energy of India.

Temperature dependence of the open-circuit photovoltage of a back surface field, diffused silicon junction has been studied analytically, including the effect of bandgap narrowing in the heavily doped back surface region. Open circuit voltage of a BSF structure has been found to be slightly less dependent on temperature as compared with that of a conventional cell. Further, the behavior of a BSF cell is found to be relatively insensitive to base layer resistivity. These results support the experimental data published by some investigators on temperature dependence of solar cells.

(Author)

A80-20734 Analysis and evaluation of isotype heterojunction solar cells. H. J. Pauwels (Gent, Rijksuniversiteit, Ghent, Belgium). *Solid-State Electronics*, vol. 22, Nov. 1979, p. 988-990. 10 refs.

The I-V characteristics and maximum efficiency condition for isotype (n-n) heterojunction solar cells using n(+)-type semiconducting oxides as windows are analyzed. The band diagram of the n(+)-n heterojunction under forward bias is presented, and particle current densities are calculated from thermionic emission theory, diffusion theory and Shockley-Read recombination theory to obtain an expression for the j-V characteristics. Band bending is found to occur exclusively in the n-type semiconductor, with the dark saturation current at a minimum when the band bending is maximum. Band bending in both semiconductors is expected at conduction band discontinuities less than zero, and at zero the n-type semiconductor becomes inverted at the interface. An analysis of electron affinities of various semiconducting solar cell components indicates that while several n(+)-p anisotype structures fulfil the maximum efficiency conditions, only SnO₂-Sn is an acceptable isotype solar cell structure.

A.L.W.

A80-20862 Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, University of Pittsburgh, Pittsburgh, Pa., April 25-27, 1979. Part 2 - Systems and control. Conference sponsored by the University of Pittsburgh. Edited by W. G. Vogt and M. H. Mickle. Pittsburgh, Pa., Instrument Society of America, 1979. 515 p. Price of five parts, \$125.

Papers are presented on such topics as models in air transportation, time series applications in modeling and simulation, reduced order modeling, machine system selection and failure, missile modeling, fire control, and large-scale systems. Attention is also given to traffic operations and control, system identification, advanced estimation methods, and probabilistic reliability.

B.J.

A80-20881 Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, University of Pittsburgh, Pittsburgh, Pa., April 25-27, 1979. Part 3 - Energy and environment. Conference sponsored by the University of Pittsburgh. Edited by W. G. Vogt and M. H. Mickle. Pittsburgh, Pa., Instrument Society of America, 1979. 603 p. Price of five parts, \$125.

Papers are presented on the following subjects: an energy allocation model for periods of severe energy shortage; modeling and simulation of coal conversion for electric power; application of nonlinear programming algorithms to the modeling of energy systems; solar energy systems; the modeling of aquatic environments; optimization techniques in power distribution planning; and models for pest ecosystem management. Attention is also given to: the modeling of social impacts of energy related development; recent advances in the modeling and simulation of electrical power/energy systems; plasmas and lasers; and air and water environmental systems.

B.J.

A80-20882 Computer modeling of coal gasification reactors. T. R. Blake (Systems, Science and Software, La Jolla, Calif.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 811-823. 19 refs. Research sponsored by the Electric Power Research Institute; Contract No. EX-76-C-01-1770.

The use of computer models in coal gasification reactor process development is discussed. In particular, the paper examines the merits of models for fluidized bed and entrained flow gasifiers wherein detailed representations of the internal gas dynamics, solid particle motion and chemical rate processes are incorporated.

(Author)

A80-20883 Fixed-bed gasifier dynamic model for IGCC control study. B. C. B. Hsieh, D. J. Ahner (General Electric Co., Schenectady, N.Y.), and G. H. Quentin (Electric Power Research Institute, Palo Alto, Calif.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 825-831.

A mathematical model was formulated to predict the dynamic performance of a dry-ash, air-blown, fixed-bed gasifier to be used in an analytical simulation control study of an integrated gasification combined cycle power plant. The modeling technique, data preparation, objectives and approaches are discussed, as well as the dynamic responses of gasifier output to input variables.

(Author)

A80-20884 A single coal particle gasification model. R. R. Cwiklinski, C. G. Vayenas, C. Georgakis, and J. Wei (MIT, Cambridge, Mass.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 833-842. 7 refs. Research supported by the Electric Power Research Institute.

An analytical model of carbon particle gasification in an oxygen-steam-CO₂ environment is presented. The model assumes finite H₂ diffusivity and CO and H₂ are allowed to oxidize infinitely fast at a flame front surrounding the spherical carbon particle. The possibility of multiple steady state solutions is discussed.

(Author)

A80-20885 Dynamic modeling of H₂S clean-up processes. J. H. Alexander, W. D. Henline, T. R. Blake, and D. E. Wilkins (Systems, Science and Software, La Jolla, Calif.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3.

Pittsburgh, Pa., Instrument Society of America, 1979, p. 867-879. 7 refs. Research supported by the Electric Power Research Institute.

A mathematical model and associated computer program have been developed for the dynamic simulation of packed absorption columns, heat exchangers, and flash drums which typically comprise product gas H₂S removal processes. Calculations and results appropriate to H₂S removal systems which employ solvents that separate by purely physical absorption mechanisms are analyzed. These test calculations are based on process system data and physicochemical parameters estimated from existing published information. It is noted that the numerical structure is general enough to incorporate any data.

V.T.

A80-20886 A thermodynamic assessment of OTEC open-cycle power systems. F. C. Chen (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 921-926. 7 refs. Contract No. W-7405-eng-26.

The thermodynamics of open-cycle OTEC power systems are reviewed, and the expected performance of open-cycle plants is assessed. A temperature-entropy diagram of the open-cycle process is presented and related to the various components of the system. Results of recent major open-cycle plant studies for floating platform systems in the submerged, semisubmerged and spar buoy configurations are summarized. An optimal thermal performance model is developed for a generalized open-cycle turbine on the basis of the range of operating parameters established in the system design studies and applied to a typical system. It is found that, for the given system, the performance (net power output per heat transfer area)

tends to maximize at a small flashdown temperature and high water velocity in smooth condenser tubes.

A.L.W.

A80-20887 Modeling and simulation of WECS assisted utility systems. R. G. Deshmukh and R. Ramakumar (Oklahoma State University, Stillwater, Okla.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 927-933. 9 refs. Research supported by Oklahoma State University.

The paper discusses a probabilistic model for wind-electric conversion systems (WECS) and employs it in a simulation study to assess the reliability and capacity credit aspects of WECS operating in parallel with a conventional utility grid, feeding a common load. The major parameters involved and their influence are studied by simulation techniques for a typical WECS located in the site 'Kahuku Upper' on the Hawaiian island of Oahu. Wind speed data over a two-year period collected by the University of Hawaii at Manoa form the basis of this study. The results and discussion should be useful to utility system planners contemplating the incorporation of WECS as a component in their future generation mix.

(Author)

A80-20888 An applications analysis for the solar industrial process heat market. S. A. Stadijhar (Solar Energy Research Institute, Golden, Colo.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 935-942. 8 refs. Contract No. EG-77-C-01-4042.

The importance of the industrial process heat market in terms of energy consumption and amenability of this market to solar thermal technology are examined. An analytical method for evaluating solar industrial process heat systems has been developed and implemented in a flexible, fast calculating, computer code - PROSYS/ECONMAT. The long-term average performance model PROSYS predicts annual energy output for several collector types, including flat-plate, nontracking concentrator, one-axis tracking concentrator, and two-axis tracking concentrator. The companion computer program ECONMAT calculates the solar equipment cost and generates a life cycle cost analysis. Analytical results demonstrate the software flexibility for use in feasibility and parametric sensitivity studies.

(Author)

A80-20889 Analysis of resource pricing for geothermal electric power production. P. Blair, M. Ervolini (Pennsylvania University, Philadelphia, Pa.), and T. Cassel. In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 1075-1080. 9 refs. Contract No. ET-78-S-02-4713.

This paper discusses the structure of a decision model for analyzing investment behavior of geothermal resource developers involved in electric power production. In particular, the sensitivity of a number of key investment decision criteria to variations in the geothermal resource price is investigated using the model. In addition a number of alternative resource pricing alternatives being considered by the industry today are reviewed and discussed.

(Author)

A80-20890 Supply and demand in input-output analysis for energy modeling. G. H. Mashayekhi (Hydro-Québec, Institut de Recherche, Varennes, Canada). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 1187-1192. 9 refs.

The paper examines the shortcomings of the input-output analysis for energy modeling where price and substitution effect is of great importance. Attention is given to the need for a systematic model which incorporates the demand and supply mechanism. A quadratic input-output analysis is introduced where the demand and supply functions can be incorporated directly into the model. In conclusion, it is noted that to implement the model, the product

demand and factor supply function coefficients should be estimated which will require more work for estimation of these coefficients.

M.E.P.

A80-20893 Computer analysis of grids currently used for CdS/Cu₂S solar cells. N. K. Annamalai, C. H. Kolbenson, and D. Jensen (Clarkson College of Technology, Potsdam, N.Y.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 1273-1277. 7 refs. NSF Grant No. ENG-78-06263.

A grid is normally used to reduce the power loss in the sheet resistance of a cell. To minimize the power loss, grid geometry and grid spacings should be optimized. Grid optimization was analyzed by using a computer program and circuit model, considering the grid geometry, grid spacings and various light generated currents. The effect of the grid line voltage drop and the current distribution were determined by using a circuit model. (Author)

A80-20894 Optimization of a solar heating system with integral compensation. J. T. Pritchard (Westinghouse Electric Corp., Baltimore, Md.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 3. Pittsburgh, Pa., Instrument Society of America, 1979, p. 1295-1299. 7 refs.

A linearized fourth order model with deterministic parameters is derived for a solar heating system. An optimal regulator solution (ORS) is found for a quadratic cost functional, and the inverse eigenvalue method is used to solve the Riccati equation such that the optimal feedback gain matrix can be found. The regulator problem is converted to a tracking loop problem by having an integrator following the error signal in the forward path. Furthermore, by augmenting the state vector and the state weighting matrix, both the optimal feedback gains and the optimal forward loop integrator gains for a state variable system can be obtained using the standard ORS. Simulations of two quasi-optimally controlled systems demonstrated that much faster temperature response is attainable using the following error, but that the cost is more control energy. J.P.B.

A80-20913 Mathematical modeling of coal gasification processes. G. D. Andria, D. F. Ronallo, and F. L. Cleary (Bituminous Coal Research, Inc., Monroeville, Pa.). In: Modeling and simulation. Volume 10 - Proceedings of the Tenth Annual Pittsburgh Conference, Pittsburgh, Pa., April 25-27, 1979. Part 5. Pittsburgh, Pa., Instrument Society of America, 1979, p. 1991-1995. 8 refs. Contract No. EF-77-C-01-1207.

This paper describes recent developments in the mathematical modeling and computer simulation of coal gasification processes. Special emphasis is placed on thermodynamic equilibrium-type simulators. Such modeling schemes are briefly described in general and with respect to coal gasification processes under development at BCR. The conceptual simplicity and pragmatic utility of these macro-type models are contrasted with their more sophisticated kinetic and fluid dynamic counterparts. This paper conveys the effectiveness and relevance of thermodynamic systems as simple simulators for coal gasification reactors and as integral components of more complex models. Several recent developments in kinetic and fluid dynamic modeling are outlined. (Author)

A80-21010 Measurements of gas-to-particle conversion in the plumes from five coal-fired electric power plants. D. A. Hegg and P. V. Hobbs (Washington, University, Seattle, Wash.). *Atmospheric Environment*, vol. 14, no. 1, 1980, p. 99-116. 48 refs. Research supported by the Electric Power Research Institute.

Airborne measurements of particles and trace gases have been obtained in the plumes from five coal-fired electric power plants situated in the West and Midwest of the United States. From these data, gas-to-particle (g-to-p) conversion rates are estimated from changes in total particle volume, changes in the ratio of the mass of particulate sulfur to the total mass of sulfur (particulate sulfur measured by two techniques), and from particle nucleation rates.

The g-to-p conversion rates ranged from 0 to 5.7% + or - 2.0% of SO₂/h for travel times of 10-162 min. The data suggest differences between plants in the partitioning of g-to-p conversion products between condensation onto existing particles and the nucleation of new particles. The relationship between particle surface area and the formation rate of particle volume at large reaction times in the plumes was similar to that found in smog chamber studies. Finally, the SO₂-to-particulate sulfate conversion rate was found to correlate well (correlation coefficient - 0.9) with a parameter indicative of the reaction of SO₂ in the plumes with ambient OH radicals. (Author)

STAR ENTRIES

N80-10022 Allerton Press, Inc., New York, N. Y. STUDY OF HEAT-PIPE HEAT EXCHANGER IN THE SMALL GAS TURBINE ENGINE SYSTEM

V. K. Shchukin, I. I. Mosin, N. V. Lokai, and Yu. V. Matveev *In its Soviet Aeron.*, Vol. 21, No. 3 1978 p 93-96 refs Transl. into ENGLISH from *Izv. Vyssh. Ucheb. Zaved. Aviat. Tekh. (USSR)*, v. 21, no. 3, 1978 p 127-132

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A theoretical optimization of the elements of heat-pipe heat exchangers in application to small gas turbine engines (SGTE), is presented in order to study the possibility of using this type of heat exchanger as a SGTE regenerator. The regeneration ratio σ sub p approximately 0.82 with admissible pressure losses in the heat exchanger passages $\Delta P = 6\%$ was obtained. In order to confirm the validity of the theoretical results, an experimental study was made of a heat exchanger matrix consisting of 49 ribbed sodium heat pipes on a specially developed test stand simulating SGTE regenerator operating conditions. This study confirms the possibility of using the heat-pipe heat exchanger as an SGTE regenerator. M.M.M.

N80-10068 Allerton Press, Inc., New York, N. Y. SELECTION OF OPTIMAL PARAMETERS OF HEAT-PIPE HEAT EXCHANGER FOR A GAS TURBINE ENGINE

N. V. Lokai and I. I. Mosin *In its Soviet Aeron.*, v. 22, no. 1 1979 p 30-34 refs Transl. into ENGLISH from *Izv. Vyssh. Ucheb. Zaved. Aviat. Tekhn. (USSR)*, v. 22, no. 1, 1979 p 41-46

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Requirements that assist in achieving the maximal heat exchanger degree of regeneration are examined. It is shown that in a specific gas turbine engine equipped with a heat exchanger the degree of regeneration can be improved by observing the following conditions: (1) The heat transfer capacity of the heat exchanger heat pipes must exceed the rate of heat transfer from the gas and air sides; (2) the condition of equality of certain dimensionless groupings on the hot and cold sides of the heat exchanger must be satisfied. R.E.S.

N80-10074 Allerton Press, Inc., New York, N. Y. DYNAMICS OF DIESEL FUEL COMBUSTION IN TURBULENT FLOW

F. A. Khamidullin, A. F. Kuzin, O. V. Stroganov, Yu. V. Troitskii, and A. V. Talantov *In its Soviet Aeron.*, v. 22, no. 1 1979 p 58-63 refs Transl. into ENGLISH from *Izv. Vyssh. Ucheb. Zaved. Aviat. Tekhn. (USSR)*, v. 22, no. 1, 1979 p 73-80

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A study of diesel fuel and also TS-1 kerosene and B-70 gasoline combustion in a turbulent stream is presented. These fuels are compared and the dependence of the combustion zone length and the combustion time on mixture composition, velocity, and initial temperature under the model combustion chamber conditions was established. M.M.M.

N80-10206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIRCRAFT ENERGY EFFICIENCY (ACEE) STATUS REPORT

Donald L. Nored, James F. Dugan, Jr., Neal T. Saunders, and Joseph A. Ziemianski *In its Aeropropulsion* 1979 1979 p 1-58 refs

Avail: NTIS HC A20/MF A01 CSCL 21E

Fuel efficiency in aeronautics, for fuel conservation in general as well as for its effect on commercial aircraft operating economics is considered. Projects of the Aircraft Energy Efficiency Program related to propulsion are emphasized. These include: (1) engine component improvement, directed at performance improvement and engine diagnostics for prolonged service life; (2) energy efficient engine, directed at proving the technology base for the next generation of turbofan engines; and (3) advanced turboprop, directed at advancing the technology of turboprop powered aircraft to a point suitable for commercial airline service. Progress in these technology areas is reported. J.M.S.

N80-10209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALTERNATIVE JET AIRCRAFT FUELS

Jack Grobman *In its Aeropropulsion* 1979 1979 p 129-148 refs

Avail: NTIS HC A20/MF A01 CSCL 21E

Potential changes in jet aircraft fuel specifications due to shifts in supply and quality of refinery feedstocks are discussed with emphasis on the effects these changes would have on the performance and durability of aircraft engines and fuel systems. Combustion characteristics, fuel thermal stability, and fuel pumpability at low temperature are among the factors considered. Combustor and fuel system technology needs for broad specification fuels are reviewed including prevention of fuel system fouling and fuel system technology for fuels with higher freezing points. J.M.S.

N80-10263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DEEP SPACE NETWORK FEASIBILITY STUDY OF TERMINATING SOUTHERN CALIFORNIA EDISON ELECTRICAL SERVICE TO GOLDSTONE

J. L. Koh *In its The Deep Space Network* 15 Oct. 1979 p 169-175

Avail: NTIS HC A09/MF A01 CSCL 14B

A cost comparison of purchased power versus generated power is discussed. Methods for waste energy recovery are examined and applications for the use of waste energy in heating and cooling systems are presented. A.W.H.

N80-10329# Grumman Aerospace Corp., Bethpage, N.Y. THE JET MEMBRANE PROCESS FOR URANIUM SEPARATION AND ENRICHMENT

John W. Brook and Vincent Calia Sep. 1979 145 p refs (RE-586) Avail: NTIS HC A07/MF A01

Isotopic enrichment of both SF₆ and UF₆ was successfully achieved using a scheme in which the working or carrier fluid is a condensable vapor, which can be thermally, rather than mechanically, pumped. The energy supply can be waste heat or solar energy. The process gas (UF₆) is introduced into a chamber in which a heavy condensable gas (the jet) flows. Due to preferential penetration of the UF₆ into the jet, the lighter species (U-235)F₆ is enriched relative to the heavy species (U-238)F₆. The enriched UF₆ is collected by a probe facing downstream in the jet and is passed to another unit for further enrichment or to a mass spectrometer for analysis. Laboratory experiments were conducted using a variety of gas combinations to investigate system parameters that were identified as major capital and energy cost drivers. A theoretical study aided in the analysis of data and in providing scaling laws. Cost analysis, based upon the measured UF₆ results and the supporting experiments, indicates that the jet membrane is a viable concept for enriching uranium industrially. A.R.H.

N80-10361* National Aeronautics and Space Administration. Pasadena Office, Calif.

MOLTEN SALT PYROLYSIS OF LATEX Patent Application
Albert J. Bauman, inventor (to NASA) (JPL) Filed 27 Apr. 1978
11 p Sponsored by NASA
(NASA-Case-NPO-14315-1; US-Patent-Appl-SN-900659) Avail:
NTIS HC A02/MF A01 CSDL 07C

The production of synthetic hydrocarbon liquid fuel from latex rich plants is reported. The pyrolysis of high isoprene latex plants such as Guayule, or extracts thereof, in a molten inorganic salt at temperatures above 300 C is described. The pyrolysis process is examined using a number of inorganic salts and a reactor is described for the hydrogen fuel production. A.W.H.

N80-10374* National Aeronautics and Space Administration. Pasadena Office, Calif.

START UP SYSTEM FOR HYDROGEN GENERATOR USED WITH AN INTERNAL COMBUSTION ENGINE Patent

John Houseman (JPL) and Donald J. Cerini, inventors (to NASA) (JPL) Issued 5 Jul. 1977 13 p Filed 22 Mar. 1976 Sponsored by NASA

(NASA-Case-NPO-13849-1; NASA-Case-NPO-13907-1;
US-Patent-4,033,133; US-Patent-Appl-SN-668783;
US-Patent-Class-60-606; US-Patent-Class-23-288R;
US-Patent-Class-48-61; US-Patent-Class-48-102A;
US-Patent-Class-48-10-3; US-Patent-Class-48-107;
US-Patent-Class-48-117; US-Patent-Class-48-DIG.8;
US-Patent-Class-60-300; US-Patent-Class-123-3;
US-Patent-Class-123-179R; US-Patent-Class-123-DIG.12;
US-Patent-Class-423-650) Avail: US Patent and Trademark Office CSDL 21D

A hydrogen generator provides hydrogen rich product gases which are mixed with the fuel being supplied to an internal combustion engine for the purpose of enabling a very lean mixture of that fuel to be used, whereby nitrous oxides emitted by the engine are minimized. The hydrogen generator contains a catalyst which must be heated to a pre-determined temperature before it can react properly. To simplify the process of heating up the catalyst at start-up time, either some of the energy produced by the engine such as engine exhaust gas, or electrical energy produced by the engine, or the engine exhaust gas may be used to heat up air which is then used to heat the catalyst.

Official Gazette of the U.S. Patent and Trademark Office

N80-10377* National Aeronautics and Space Administration. Pasadena Office, Calif.

CONTINUOUS COAL PROCESSING METHOD AND MEANS Patent Application

Porter R. Ryason, inventor (to NASA) (JPL) Filed 28 Sep. 1976
31 p Sponsored by NASA
(NASA-Case-NPO-13758-2; US-Patent-Appl-SN-727444) Avail:
NTIS HC A03/MF A01 CSDL 21D

A coal pump is provided in which solid coal is heated in the barrel of an extruder under pressure to a temperature at which the coal assumes plastic properties. The coal is continuously extruded, without static zones, using, for example, screw extrusion preferably without venting through a reduced diameter die to form a dispersed spray. The dispersed coal may be continuously injected into vessels or combustors at any pressure up to the maximum pressure developed in the extrusion device. The coal may be premixed with other materials such as desulfurization aids or reducible metal ores so that reactions occur, during or after conversion to its plastic state. Alternatively, the coal may be processed and caused to react after extrusion, through the die, with liquid oxidizers, whereby a coal reactor is provided. Alternative utilization of the device may be to secure continuous pyrolysis of the coal or to feed the extruded coal into furnaces operating at pressures near ambient. NASA

N80-10379* BDM Corp., McLean, Va.
COAL CONVERSION PROCESSES AND ANALYSIS METHODOLOGIES FOR SYNTHETIC FUELS PRODUCTION Final Report
5 Oct. 1979 285 p refs

(Contract NAS8-33608)

(NASA-CR-161322; BDM/W-79-548-TR) Avail: NTIS HC A13/MF A01 CSDL 21D

Information to identify viable coal gasification and utilization technologies is presented. Analysis capabilities required to support design and implementation of coal based synthetic fuels complexes are identified. The potential market in the Southeast United States for coal based synthetic fuels is investigated. A requirements analysis to identify the types of modeling and analysis capabilities required to conduct and monitor coal gasification project designs is discussed. Models and methodologies to satisfy these requirements are identified and evaluated, and recommendations are developed. Requirements for development of technology and data needed to improve gasification feasibility and economics are examined. A.W.H.

N80-10382# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF SYN FUEL TRANSPORTATION TO YEAR 2000

W. Wakamiya, K. B. Sebelien, and M. A. Parkhurst Mar. 1979
113 p refs

(Contract EY-76-C-06-1830)

(PNL-2768) Avail: NTIS HC A06/MF A01

The potential problems in the transportation of synthetic fuels (synfuels) are discussed and identified. The emergence of transportation-related problems in shale oil and coal synfuel development expected to be highly dependent upon their chemical similitude with analogous fossil fuels. Definitive resolution of the question of whether new transportation problems exist is dependent upon clear characterization of the synfuels chemical composition. Hydrogen and methanol represent unique cases since these materials are already in commercial production. The major transportation problem identified with fuel economics based on these materials is related to bulk use. To date, shipment volumes are relatively small and, in the case of hydrogen, can be accommodated with costly, more specialized packaging. Scale-up for major energy use may introduce a new set of transportation problems. DOE

N80-10383# Escher Technology Associates, St. Johns, Mich.
SURVEY OF LIQUID HYDROGEN CONTAINER TECHNIQUES FOR HIGHWAY VEHICLE FUEL SYSTEM APPLICATIONS

W. J. D. Escher Nov. 1978 66 p refs

(Contract EC-77-X-01-2752)

(HCP/M2752-01) Avail: NTIS HC A04/MF A01

The design and operational features of four different liquid hydrogen container types, three of which have served operationally as vehicle fuel tanks, and rough production lot cost estimates for a nominal 50 gallon horizontal cylindrical liquid hydrogen container applicable to vehicle service are reported. A unique semiautomatic liquid hydrogen service station developed in Germany is described. A general assessment of the state of technology of vehicle hydrogen containers and associated systems is given, including the identification of pacing items recommended to be addressed initially in prospective R and D activities in this field. DOE

N80-10384# Sandia Labs., Livermore, Calif.
APPLICATIONS ANALYSIS OF FIXED SITE HYDROGEN STORAGE

J. J. Iannucci and S. L. Robinson May 1979 23 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8272) Avail: NTIS HC A02/MF A01

The potential applications and requirements for fixed site storage in a scenario of wide spread hydrogen use are examined and quantified. An envisioned hydrogen production/distribution/end-use cycle is scrutinized to identify the storage needs for both continuous and intermittent sources including solar. The most pressing need for storage is at the distribution point, in concurrence with current natural gas practice. Caverns and similar underground storage techniques are the most promising modes due to their low cost relative to all other options examined. Since a large volume of natural gas storage is presently in service, a pressing need to develop fixed site hydrogen storage technology (beyond the conversion of this underground storage to hydrogen) was not identified. DOE

N80-10386# Department of Energy, Morgantown, W. Va. Energy Technology Center.

FLUIDIZED-BED COMBUSTION OF HIGH SULFUR COALS

J. S. Mei, J. S. Halow, U. Grimm, and R. L. Rice Apr. 1979 149 p refs

(METC/RI-79/4) Avail: NTIS HC A07/MF A01

The sulfur retention capability of an atmospheric fluidized-bed combustor (AFBC) burning a high sulfur coal was evaluated in light of the EPA proposed New Source Performance Standards and their potential impact on AFBC technology. A high volatile bituminous Pittsview coal with 4.52 percent sulfur content was selected and Greer limestone and Tymochtee dolomite were used as sulfur sorbents. Combustion tests were carried out at various operating conditions to develop AFBC engineering and emissions data on this high sulfur coal. Ninety or greater percent of sulfur retention was attained in 9 of the 19 balance periods. Eighty-five or greater percent sulfur retention was attained in 14 of the 19 balance periods. Results demonstrate that the proposed new standards for sulfur dioxide emissions can be met by AFBC's.

DOE

N80-10387# TRW Energy Systems Planning Div., McLean, Va. **METHANE RECOVERY FROM COALBEDS Annual Report, Dec. 1977 - Dec. 1978**

1978 29 p

(Contract DE-AC21-78MC-08089)

(DOE/MC-08089-T1) Avail: NTIS HC A03/MF A01

Work done in the engineering and integration effort in the Morgantown Energy Technology Center program to recover and utilize methane from coalbeds is summarized. The contract requirements and approach are outlined. The work accomplished includes the development of the Unminable Drilling Plan, performance of testing and data analysis for wells into coal seams, development of three conceptual recovery and utilization designs. Milestone and expenditure charts are provided.

DOE

N80-10388# Mobil Research and Development Corp., Princeton, N. J.

RESEARCH GUIDANCE STUDIES TO ASSESS GASOLINE FROM COAL BY METHANOL-TO-GASOLINE AND SASOL-TYPE FISCHER-TROPSCH TECHNOLOGIES Final Report

Max Schreiner Aug. 1978 324 p refs

(FE-2447-13) Avail: NTIS HC A14/MF A01

A technical and economic comparison between the new Mobil methanol-to-gasoline technology under development and the commercially available Fischer-Tropsch technology for the production of motor gasoline meeting U.S. quality standards is presented. Except for the Mobil process, processes used are commercially available. Coproduction of products, namely SNG, LPG and gasoline, is practiced. Four sensitivity cases were also developed in less detail from the two base cases. In all areas, the Mobil technology is superior to Fischer-Tropsch: process complexity, energy usage, thermal efficiency, gasoline selectivity, gasoline quality, investment and gasoline selectivity, investment and gasoline cost. Principal advantages of the Mobil process are its selective yield of excellent quality gasoline with minimum ancillary processing.

DOE

N80-10389# Mitre Corp., McLean, Va.

NEAR TERM POTENTIAL OF WOOD AS A FUEL

Jan. 1979 71 p refs

(Contract EG-77-C-01-4101)

(HCP/C4101) Avail: NTIS HC A04/MF A01

The sources of wood as a fuel are cited. Technologies available to expand the near-term use of wood fuel include direct combustion, low-Btu gasification in the presence of air, pyrolysis to char, liquid fuel, and low-Btu gas in the absence of air, and densification. Life-cycle costs were evaluated for these technologies. Incentives to increase the use of wood fuel in the near term are identified. Systems manufacturers, architecture and engineering firms, and users are listed.

DOE

N80-10390# Institute of Gas Technology, Chicago, Ill.

DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW BTU GASES AS INDUSTRIAL PROCESS FUELS. PROJECT 61004 SPECIAL REPORT NO. 4: HIGH-FORWARD-MOMENTUM BURNER

R. T. Waibel and E. S. Fleming Nov. 1978 42 p refs
(Contract EX-76-C-01-2489)

(FE-2489-33) Avail: NTIS HC A03/MF A01

Data were gathered to determine the performance of a high-forward-momentum burner when retrofit with three low-to-medium-Btu gases. The burner was fired on the IGT pilot-scale test furnace with a load simulating one zone of a continuous refractory kiln or one instant during the heat-up of a batch kiln. The low- and medium-Btu gases simulated for these combustion trials were Koppers-Totzek oxygen, Wellman-Galusha air, and Winkler air fuel gases. All of the substitute fuels exhibited stable flames when directly retrofit on the burner. Koppers-Totzek oxygen gave a thermal efficiency slightly greater than that for natural gas, but Wellman-Galusha and Winkler air fuel gases each had lower efficiencies. Koppers-Totzek oxygen and Wellman-Galusha air fuel gases had flame lengths longer than that for natural gas, whereas Winkler air fuel gas had a flame length comparable to the natural gas flame.

DOE

N80-10391# Institute of Gas Technology, Chicago, Ill.

DEVELOPMENT OF GAS TURBINE FUELS AND COMBUSTION: AN OVERVIEW

A. A. Fejer 1979 12 p refs Presented at New Fuels and Advances in Combustion Technologies, New Orleans, 26-30 Mar. 1979

(Contract EX-76-C-01-2433)

(CONF-790337-4) Avail: NTIS HC A02/MF A01

The characteristic features of gas turbine engines are described contrasting them with their chief competitor, the steam cycle. The focus is on the aerodynamic processes in the combustion chambers of traditional engines and includes an outline of the changes that are to be expected with the introduction of the synthetic and coal derived fuels.

DOE

N80-10392# Institute of Gas Technology, Chicago, Ill.

COAL CONVERSION SYSTEMS: TECHNICAL DATA BOOK

1978 585 p

(Contract EX-76-C-01-2286)

(HCP/T2286-01; LC-78-606163; TP759.C52) Avail: NTIS HC A25/MF A01

Technical information necessary for the design and operation of coal conversion facilities is provided. Such facilities include the conversion of coal to environmentally acceptable fuel forms, or to electric power by way of advanced technologies. Physical, chemical, thermodynamic data, and correlations are included along with procedures necessary to develop a new process or to design, build, and operate a coal conversion plant.

DOE

N80-10393# Mitre Corp., McLean, Va. METREK Div.

BIOMASS-BASED ALCOHOL FUELS: THE NEAR-TERM POTENTIAL FOR USE WITH GASOLINE

W. Park, G. Price, and D. J. Salo Aug. 1978 84 p refs

(Contract EG-77-C-01-4101)

(HCP/T4101-03) Avail: NTIS HC A05/MF A01

The requirements and prospects for a nationwide alcohol-gasoline fuel system based on alcohols derived from biomass resources are assessed. Technological and economic factors of the production and use of biomass-based methanol and ethanol fuels are evaluated relative to achieving 5 or 10 percent alcohol-gasoline blends by 1990. It is concluded the maximum attainable is a nationwide 5 percent methanol or ethanol-gasoline system replacing gasoline by 1990. Relative to existing gasoline systems, costs of alcohol-gasoline systems will be substantial.

DOE

N80-10395# Battelle Columbus Labs., Ohio.

SUGAR CROPS AS A SOURCE OF FUELS. VOLUME 1: AGRICULTURAL RESEARCH Final Report

E. S. Lipinsky, S. Kresovich, T. A. McClure, D. R. Jackson, W. T. Lawhon, A. A. Kayloncu, and E. L. Daniels 31 Jul. 1978 222 p refs

(Contract W-7405-eng-92)

(TID-29400/1) Avail: NTIS HC A10/MF A01

Narrow-row spacing experiments were conducted. They promote more rapid canopy closure which helps a short season

location more than a long season location. Sweet sorghum experiments indicate favorable yields compared with sugarcane, and yield increases with close spacing in all areas. The project team concludes that sweet sorghum has considerable fuel potential, based on its ability to grow wherever corn or soybeans grow. Initial evaluation of the Tilby cane separator process, which separates the pith from the rind fiber without crushing and grinding, indicates that the process is promising as a means of obtaining fermentable sugars at low cost. The advantages of the Tilby process are low energy consumption, high value for the rind fiber coproducts in products that perform like plywood, pulp or paper making, and ability to use high fiber sugarcane or sweet sorghum. DOE

N80-10396# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

BIOMASS ENERGY ENHANCEMENT: A REPORT TO THE PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY Final Report

Michael Jerry Antal, Jr. Jul. 1978 140 p refs
(Contract EQ9AD499; Grant EPA-R-804836)
(PB-296624/0) Avail: NTIS HC A07/MF A01 CSDL 21D

The technical and economic potential for enhancing the energy value of biomass is examined and the feasibility of using solar heat to gasify biomass is developed. With improved technology, this would permit the energy carried by the synthetic fuel leaving the conversion facility to exceed or equal the biomass fuel input. The potential impact of biomass energy enhancement technologies is examined in a case study for New Jersey. The outcome is favorable for solar heat. GRA

N80-10397# New Mexico Univ., Albuquerque. Technology Application Center.

HYDROGEN AS A FUEL. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jul. 1979

Gerald F. Zollars Aug. 1979 24 p Sponsored in part by NTIS
(NTIS/PS-79/0771/0) Avail: NTIS HC \$28.00/MF \$28.00 CSDL 21D

The 219 citations concern the use of hydrogen as a fuel for aircraft and automobiles. Topics covered include storage, fuel combustion studies, gas mixtures, and energy conversion efficiency. GRA

N80-10398# Wisconsin Univ. Center System, Rice Lake.
ENERGY AND ECONOMIC ASSESSMENT OF ANAEROBIC DIGESTERS AND BIOFUELS FOR RURAL WASTE MANAGEMENT Final Report

Tom P. Abeles, David Freedman, Laura A. DeBaere, and David A. Ellsworth Dec. 1978 176 p refs
(Grant EPA-R-804457)
(PB-296523/4; EPA-600/7-78-174) Avail: NTIS HC A09/MF A01 CSDL 21D

A technological and socioeconomic assessment of anaerobic digester feasibility for small to midsize livestock operations was undertaken. Three full scale digesters and one pilot scale facility were under various degrees of monitoring and evaluation to assess design and operational problems as they affect the adoption and establishment of farm scale anaerobic digesters. Materials handling presented the greatest obstacle to satisfactory operation of the full scale systems. The system becomes more economical if the biogas can be used on site for direct thermal loads, suggesting that the economic feasibility of anaerobic digesters is site specific and should be closely integrated with the total farming operation. GRA

N80-10400# Economics, Statistics and Cooperatives Service, Washington, D. C. Natural Resource Economics Div.

GROWING ENERGY: LAND FOR BIOMASS FARMS Final Report

Kathryn A. Zeimetz Jun. 1979 41 p refs
(PB-296650/5; AER-425) Avail: NTIS HC A03/MF A01 CSDL 21D

The utilization of high quality land to maximize energy gain and minimize environmental hazards are considered. It was

concluded that alternate sources of food and fiber production must be allocated as some lands are diverted to energy farms. GRA

N80-10401# New Mexico Univ., Albuquerque. Technology Application Center.

HYDROGEN PRODUCTION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Report, 1977 - Jul. 1979

Gerald F. Zollars Springfield, Va. NTIS Aug. 1979 45 p Sponsored by NTIS
(NTIS/PS-79/0773/6) Avail: NTIS HC \$28.00/MF \$28.00 CSDL 21D

This bibliography cites 169 articles from the international literature concerning hydrogen production. Techniques examined include solar energy conversion, coal gasification, thermal dissociation, and water electrolysis. GRA

N80-10402# New Mexico Univ., Albuquerque. Technology Application Center.

HYDROGEN STORAGE AS A HYDRIDE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Report, 1975 - Jul. 1979

Gerald F. Zollars Springfield, Va. NTIS Aug. 1979 29 p Sponsored by NTIS
(NTIS/PS-79/0772/8) Avail: NTIS HC \$28.00/MF \$28.00 CSDL 21D

Articles from the international literature concerning the storage of hydrogen in various metal hydrides are cited. Binary and intermetallic hydrides are considered. Specific alloys discussed are iron-titanium, lanthanum-nickel, magnesium-copper, and magnesium-nickel among others. This bibliography contains 97 entries. GRA

N80-10414# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences.

MINIMUM COST TRANSMITTER-RECEIVER ANTENNA PAIRS

G. Moyer and H. Hinz Sep. 1979 26 p refs
(RM-690) Avail: NTIS HC A03/MF A01

There are two types of solutions when applying the optimal control theory to antenna design. The cost (C) is an arbitrary function of the radii of the receiver ($R_{sub 0}$) and of the transmitter ($R_{sub 1}$). When the received power ($W_{sub 0}$) divided by the area is small, as happens in the proposed satellite solar power station (SSPS), the value of the power density at the center of the receiver should be left open. Then the problem simplifies to such an extent that it can be solved with considerable accuracy using only ordinary calculus and graphs provided. The product ($R_{sub 0}$) ($R_{sub 1}$) depends only on the power ratio ($W_{sub 0}$) ($W_{sub 1}$) and can be obtained from a graph. The radius of the transmitter can then be replaced in the cost function and the best value of the radius of the receiver can be found from $dC/d(R_{sub 0}) = 0$. The transmitter and receiver power density distributions are proportional and resemble a truncated Gaussian distribution. As $W_{sub 0}/sq\ pi (R_{sub 0})$ becomes larger the power density at the center of the receiver reaches its upper limit. After this point the problem must be solved with an additional state variable and constraint using a computer program. Numerical results are presented for the SSPS. A.R.H.

N80-10443# Los Alamos Scientific Lab., N. Mex.
THE 50kA FLUX PUMP FOR THE SUPERCONDUCTING TRANSMISSION LINE TEST BED

Stefan L. Wipf Aug. 1978 13 p refs
(Contract W-7405-eng-36)
(LA-6953-MS) Avail: NTIS HC A02/MF A01

A 50 kA, rotating field-type flux pump is suggested as a power supply for the superconducting transmission line test bed. A basic design was developed as an extension to a previous 12 kA pump. The important design principles are explained. Special emphasis is given to the less-certain aspects of the extrapolation and eight improvements are suggested. The three most important ones are choosing the material for a pump sheet, making the pump sheet out of a specially designed wire cloth, and arranging the return leads adjacent to the pump sheet through the pole gap. Other improvements easily incorporated into the

basic design are shading poles, rare earth pole pieces, and superconducting outside windings. DOE

N80-10472# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE LIMITS FOR LIQUID-METAL HEAT PIPES CONTAINING LONG ADIABATIC SECTIONS

F. Coyne Prenger, Jr. and J. E. Kemme 1979 6 p refs
 Presented at 14th Intersociety Energy Conversion Conf., Boston, 5-10 Aug. 1979
 (Contract W-7405-eng-36)
 (LA-UR-79-1241) Avail: NTIS HC A02/MF A01

Analytical and experimental investigation of the performance limits of liquid-metal heat pipes containing long adiabatic sections were made. An analytical model describing the vapor flow and including the effects of wall friction and compressibility is presented. Performance limits and axial temperature profiles of a sodium-filled, stainless steel heat pipe were measured for comparison with the analytical results. Complete validation of the analytical model requires further experiments. The results show that a transition from laminar turbulent vapor flow occurs in the adiabatic section with an accompanying decrease in the heat pipe performance limit. The reduced performance results from an increased wall friction factor for the turbulent flow. DOE

N80-10502# Oak Ridge National Lab., Tenn.
STEAM TURBINES

John T. Meador Oct. 1978 110 p refs
 (Contract W-31-109-eng-38)
 (ANL/CES/TE-78-7) Avail: NTIS HC A06/MF A01

The selection, classification, and average shaft efficiencies are discussed of some small-to-medium size steam turbines that can be used for base-load, turbine-generator units to meet both the electrical and thermal energy demands of several communities, as specified in evaluations for Integrated Community Energy Systems (ICES). Shaft efficiencies are evaluated by combining the average internal turbine efficiencies and the Rankine steam-cycle efficiencies for several combinations of steam inlet conditions under conditions of both fully condensing and non condensing exhaust steam. Efficiencies of very small turbines for mechanical drive of compressors or power plant auxiliaries also are estimated. Two examples are given of the input data necessary to establish preliminary costs for an industrial-extraction type turbine that may be adapted to ICES. Some data on operational considerations and cost factors are included. DOE

N80-10504# Atomics International, Golden, Colo. Rockwell Hanford Operations.
QUALITY ASSURANCE IN ALTERNATIVE ENERGY SOURCES

R. D. Hammond 2 Feb. 1979 14 p Presented at the First Annual Western Energy Quality Assurance Seminar, San Francisco, 7 Apr. 1979
 (Contract EY-77-C-06-1036; Contract EY-77-C-1030)
 (RHO-SA-107) Avail: NTIS HC A02/MF A01

The Hanford history, description of the radwaste efforts taking place, future plans, and highlights of the increasing role of quality assurance are outlined. DOE

N80-10584# Oak Ridge National Lab., Tenn.
COMPUTER SOFTWARE TO CALCULATE AND MAP GEOLOGIC PARAMETERS REQUIRED IN ESTIMATING COAL PRODUCTION COSTS Final Report

R. B. Honea, C. H. Petrich, D. L. Wilson, C. A. Dillard, R. C. Durfee, and J. A. Faber (Denison Univ.) Apr. 1979 124 p refs
 Sponsored in part by Electric Power Research Inst.
 (Contract W-7405-eng-26; EPRI Proj. 804)
 (EPRI-EA-674) Avail: NTIS HC A06/MF A01

A general overview of the software and methodology developed to calculate parameters such as surface slope and coal seam thickness and depth is provided along with sample map output which indicates the geographical distribution of these geologic characteristics. A user guide for implementing the software is included. Coal production, coal recovery, and coal resource calculation studies are reviewed. This system will be useful to utilities and coal mine operators alike in estimating

costs through comprehensive assessment before mining takes place. DOE

N80-10593 Drexel Univ., Philadelphia, Pa.
OPTIMAL CONTROL OF DISTRIBUTED PARAMETER SYSTEMS FOR SOLAR THERMAL APPLICATIONS
 Ph.D. Thesis

Abraham Orbach 1979 252 p
 Avail: Univ. Microfilms Order No. 7923085

The necessary conditions for optimality, which generate a set of equations whose solution yields the optimal control, were derived. It was shown that if the system and the performance index were bilinear and if the control vector was constrained, the optimal solution yielded a bang-bang policy for which the switching functions were obtained. These results were applied to the optimal control of the solar collector loop systems where the objective was to control the fluid velocity so as to maximize the net energy collected. A sensitivity study of a nonlinear first order in time and space system is presented. Three types of distributed parameter models, which represent the dynamics of the flat plate solar collector were derived. Dissert. Abstr.

N80-10595*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

NASA-LEWIS CLOSED-CYCLE MAGNETOHYDRODYNAMIC PLANT ANALYSIS

Paul F. Penko 1979 13 p refs Presented at Closed-Cycle Magnetohydrodynamics Specialists Meeting, Bozeman, Montana, 21 Jun. 1979
 (Contract EF-77-A-01-2674)
 (NASA-TM-79249; DOE/NASA-2674-79/7; E-159) Avail: NTIS HC A02/MF A01 CSCL 10A

A brief review of preliminary analyses of coal fired closed cycle MHD power plants is presented. The performance of three power plants with differing combustion systems were compared. The combustion systems considered were (1) a direct coal-fired combustor, (2) a coal gasifier with in-bed desulfurization and (3) a coal gasifier requiring external fuel gas cleanup. Power plant efficiencies (auxiliary power excluded) were 44.5, 43, and 41 percent for the three plants, respectively. R.E.S.

N80-10596# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.

THE FIRST SMALL POWER SYSTEM EXPERIMENT, PHASE 1: ENGINEERING EXPERIMENT NO. 1 Final Report, 5 Jul 1978 - 4 May 1979

H. E. Jones et al 1978 570 p Prepared for JPL
 (Contract JPL-955116)
 (NASA-CR-162417) Avail: NTIS HC A25/MF A01 CSCL 10A

Conceptual designs were generated for several small solar thermal electric power plant configurations with a nominal size of one MWe and 0.4 annual capacity factor. Three startup times for a near term engineering experiment were considered for an application involving a small community and utility system. System characteristics, performance, and costs were determined for the nominal size plants. Size variations of from 0.5 to 10 MWe and from zero storage capacity to 0.7 annual capacity factor were evaluated with respect to cost and performance impact. Basic design goals for all the near term systems were: (1) high operational reliability; (2) minimum risk of failure; (3) commercial potential; and (4) low total experiment cost. K.L.

N80-10599# Committee on Science and Technology (U. S. House).

PASSIVE SOLAR ENERGY PROGRAMS AND PLANS

Washington GPO 1978 432 p Hearing before the Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 19 Sep. 1978
 (GPO-36-211) Avail: Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration

Testimony delivered and statements received regarding passive solar energy systems development under the Solar Heating

and Cooling Demonstration Act (PL 93-409) are presented. Basic approaches are described as well as the use of specific heat absorbing materials in building construction and the use of windows and baffles to control the amount of sunlight received. Additional research needs are examined. Market demand, technology transfer, and technology utilization are also considered. A.R.H.

N80-10600*# RCA Labs., Princeton, N. J. David Sarnoff Research Center.

ANALYSIS OF S-BAND SOLID-STATE TRANSMITTERS FOR THE SOLAR POWER SATELLITE Final Report, 1 Nov. 1978 - 1 Jun. 1979

E. F. Belohoubek, M. Ettenberg, H. C. Huang, M. Nowogrodzki, and F. N. Sechi 1 Jun. 1979 79 p refs (Contract NAS9-15755)

(NASA-CR-160320) Avail: NTIS HC A05/MF A01 CSCL 10A

The possibility of replacing the Reference System antenna in which thermionic devices are used for the dc-to-microwave conversion, with solid-state elements was explored. System, device, and antenna module tradeoff investigations strongly point toward the desirability of changing the transmitter concept to a distributed array of relatively low power elements, deriving their dc power directly from the solar cell array and whose microwave power outputs are combined in space. The approach eliminates the thermal, weight, and dc-voltage distribution problems of a system in which high power tubes are simply replaced with clusters of solid state amplifiers. The proposed approach retains the important advantages of a solid state system: greatly enhanced reliability and graceful degradation of the system. A.R.H.

N80-10601*# Honeywell, Inc., Minneapolis, Minn. **OCMULGEE NATIONAL MONUMENT VISITOR CENTER SOLAR HEATING AND COOLING SYSTEM DESIGN REVIEW DATA**

May 1978 72 p refs Prepared for NASA and DOE (Contract NAS8-32093)

(NASA-CR-150706) Avail: NTIS HC A04/MF A01 CSCL 10A

The design of a solar heating and cooling system is documented. Solar collectors, design approaches, system trade studies, and preliminary specifications are discussed. K.L.

N80-10602*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 9 Jul. - 9 Oct. 1976

Oct. 1976 81 p Prepared for DOE (Contract NAS8-32093)

(NASA-CR-150618; HONEYWELL-F3437-QR-101) Avail: NTIS HC A05/MF A01 CSCL 10A

Solar heating and heating/cooling systems were designed for single family, multifamily, and commercial applications. Subsystems considered included solar collectors, heat storage systems, auxiliary energy sources, working fluids, and supplementary controls, piping, and pumps. K.L.

N80-10603*# Energy Research Corp., Danbury, Conn. **TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT, PHASE 2 Quarterly Report**

Larry Christner Jun. 1979 72 p Prepared for DOE (Contract DEN3-67)

(NASA-CR-159705; DOE/NASA/O067-79-2; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

A technique for producing an acid inventory control member by spraying FEP onto a partially screened carbon paper backing is discussed. Theoretical analysis of the acid management indicates that the vapor composition of 103% H3PO4 is approximately 1.0 ppm P4O10. An SEM evaluation of corrosion resistance of phenolic resins and graphite/phenolic resin composites in H3PO4 at 185 C shows specific surface etching. Carbonization of graphite/phenolic bipolar plates is achieved without blistering. K.L.

N80-10604*# University of Western Kentucky, Bowling Green. **MSFC SOLAR HEATING AND COOLING HIGH SPEED PERFORMANCE (HISPER) CODE VALIDATION Final Report**

Henry M. Healey 12 Oct. 1979 15 p (Contract NAS8-33387)

(NASA-CR-161323) Avail: NTIS HC A02/MF A01 CSCL 10A

The status of the Solar Heating and Cooling Project is reported. Modifications to the HISPER program are outlined, and recommendations concerning the validation study of HISPER are included. F.O.S.

N80-10605# Westinghouse Electric Corp., Eddystone, Pa. **SCREENING EVALUATION OF NOVEL POWER CYCLES INTEGRATED WITH GASIFICATION PLANTS Final Report**

R. W. Foster-Pegg and R. V. Garland Feb. 1979 136 p (Contract EPRI Proj. 990-3)

(EPRI-AF-1002) Avail: NTIS HC A07/MF A01

Three basic plant configurations were studied: (1) the condensing combined cycle, which includes combustion turbines, gas expanders and condensing steam turbines; (2) the single cycle, which is comprised of combustion turbines and gas expanders, but no steam turbines; and (3) the noncondensing combined cycle, which utilizes combustion turbines, gas expanders and a non-condensing steam turbine. The most efficient plant configuration studied included a non-condensing steam turbine. The best plant heat rate calculated for this configuration is 7956 Btu/Kwh. DOE

N80-10606# Argonne National Lab., Ill. Materials Science Div.

MATERIALS TESTING FOR CENTRAL RECEIVER SOLAR-THERMAL POWER SYSTEMS

S. Majumdar 1979 14 p (Contract W-31-109-eng-38)

(DOE/TIC-10103) Avail: NTIS HC A02/MF A01

The determination of specific elevated temperature mechanical properties of materials used for critical components in solar control receiver power systems is described. The biaxial creep fatigue testing of type 316H stainless steel superheater tubing is discussed. A survey of sodium effects on candidate materials for solar-thermal electric piping and steam generators is presented. The mechanical properties data generation is evaluated. DOE

N80-10607# Department of Energy, Washington, D. C. Energy Information Administration.

ECONOMIC STRUCTURE, AGGREGATE PRODUCTION FUNCTIONS AND THE DEMAND FOR ENERGY AS AN INTERMEDIATE PRODUCT: A PRELIMINARY ANALYSIS

G. M. Lady Dec. 1978 57 p refs

(DOE/EIA-0103/8) Avail: NTIS HC A04/MF A01

The relationship between the price elasticity of demand for energy as a factor of production and differences in economic structure was investigated. A model of general economic equilibrium is constructed utilizing a constant-elasticity-of-substitution production function. Using this model the price elasticity of demand for an intermediate product (energy) is determined under alternative structural assumptions (i.e., the degree to which the production process for the intermediate product directly utilizes primary factors of production). For an open economy and the case of energy, these assumptions could concern the degree to which the economy utilizes its own versus imported energy resources. DOE

N80-10608# Sandia Labs., Albuquerque, N. Mex. **DISPERSED POWER SYSTEMS AND TOTAL ENERGY**

V. L. Dugan Nov. 1978 3 p Presented at AIAA Conf. on Solar Energy, Phoenix, Ariz., 27 Nov. 1978

(Contract EY-76-C-04-0789)

(SAND-78-2006C; Conf-781133-3) Avail: NTIS HC A02/MF A01

The variations of solar systems considered for dispersed applications are defined, and their relative benefits and costs are examined. Also, the role and benefits of total energy systems in dispersed applications are discussed. Although dispersed solar

power systems offer large stored energy multiplication factors, they exhibit a large materials and land dependency. The importance of using most plentiful and available materials and planning a recycling materials use strategy are emphasized. DOE

N80-10609# Sandia Labs., Albuquerque, N. Mex.
**SAFETY AND ENVIRONMENTAL IMPLICATIONS DOE/
 SANDIA MIDTHERATURE SOLAR SYSTEMS TEST
 FACILITY**

J. A. Leonard Nov. 1978 7 p Presented at Environ. Control Symp., Washington, D.C., 28 Nov. 1978
 (Contract EY-76-C-04-0789)
 (SAND-78-2292C; Conf-781109-8) Avail: NTIS HC A02/MF A01

The Midthemperature Solar Systems Test Facility (MSSTF) in Albuquerque, New Mexico, is presented. The MSSTF is, at 32 kWe, the largest solar electric power plant in the U.S. and also represents the world's first application of the solar total energy concept to an actual load, an 1100 sq m office building. DOE

N80-10610# Booz-Allen and Hamilton, Inc., Bethesda, Md.
**EPRI NEW ENERGY RESOURCES DEPARTMENT STRAT-
 EGY PAPER Final Report, Jan. 1979**

Michael Lotker 1979 114 p
 (EPRI-ER-979) Avail: NTIS HC A06/MF A01

The rationale for national and utility industry involvement in new energy resources (NER) technology is presented. The procedures currently being used to formulate programs in each of the NER technologies are described. DOE

N80-10611# California Univ., Berkeley. Lawrence Berkeley Lab.

ANOTHER LOOK AT ENERGY CONSERVATION

L. Schipper 1978 24 p, refs Presented at Amer. Econ. Assoc., Chicago, 30 Aug. 1978
 (Contract W-7405-eng-48)
 (LBL-7893; Conf-7808104-1) Avail: NTIS HC A02/MF A01

The need for energy conservation in U.S. buildings, industry and the transportation sector, the effects of the amount and cost of energy supplies on energy conservation, and goals of a national energy policy are discussed. DOE

N80-10612# System Development Corp., Santa Monica, Calif.
**THE 10MW(e) SOLAR THERMAL CENTRAL RECEIVER
 PILOT PLANT: HELIOSTAT FOUNDATION AND INTERFACE
 STRUCTURE INVESTIGATION**

R. K. Shogren and J. T. Phillips 28 Aug. 1978 87 p refs
 Sponsored by Sandia Labs.
 (Contract EY-76-C-04-0789)
 (SAND-78-8180) Avail: NTIS HC A05/MF A01

Foundation design requirements for heliostats for the 10 MWe Solar Thermal Power Plant (STPP) were investigated. Soils data were reviewed and a soils investigation specification and recommendations were prepared as required. Foundation to collector interface requirements were studied. Candidate foundation designs were prepared with associated cost studies. Grading requirements recommendations consistent with technical and budgetary restrictions, and recommendations for construction and test of prototype foundations were developed. DOE

N80-10613# Battelle Pacific Northwest Labs., Richland, Wash.
**SUMMARY REPORT OF THE SOLAR REFLECTIVE MATERI-
 ALS TECHNOLOGY WORKSHOP**

M. A. Lind and L. E. Ault Oct. 1978 93 p Workshop held at Denver, 28-30 Mar. 1978
 (Contract EY-76-C-06-1830)
 (PNL-2763; Conf-780380) Avail: NTIS HC A05/MF A01

Solar reflector materials technology was assessed. Metals, metallic films and alloys, and dielectric or ceramic stacks were considered as reflecting surface materials. Protective coatings discussed included polymer paints and films, inorganic coatings, and thin glass. The mirror support structures considered were polymer foams, cellular glass, aluminum honeycomb, wood, and fiberglass and epoxy composites. The requirements and properties for reflector materials were discussed along with environmental tests and actual field experiences with solar collector structures. High

concentration ratio and central receiver concepts were emphasized. K.L.

N80-10616# Combustion Engineering, Inc., Windsor, Conn.
 Power Systems Group.
**MDAC/ROCKETDYNE SOLAR RECEIVER: DESIGN
 REVIEW**

H. M. Payne Aug. 1978 130 p refs
 (Contracts EY-76-C-04-0789; AT(29-1)-789)
 (SAND-78-8188; ASA-78-06) Avail: NTIS HC A07/MF A01

The adequacy of the design in meeting the requirements of the solar central receiver (boiler) over a commercial lifetime of 30 years was assessed for an external solar heated receiver, composed of a multiple of modular panels arranged in parallel and operating on the once-through steam generation principle. Each panel is composed of welded tangent tubes, connected between inlet and outlet headers. Subcooled water enters the bottom headers, flows upward, absorbs heat, produces saturated steam throughout the two phase region, and exits at the top as superheated steam. Tube size and material are the same for both commercial and pilot plants. Panel sizes are different between the two plants. Commercial plant heat flux is approximately 2.8 times that of the pilot plant. Structural supports and attachments of both designs are similar. Control of final superheat temperature is maintained by varying the water flow to each of the panels, according to the thermal absorption of each panel. DOE

N80-10617# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

**ENERGY INFORMATION DATA BASE. CORPORATE
 AUTHOR ENTRIES Progress Report, Jun. 1978 - Mar.
 1979**

Mar. 1979 40 p
 (DOE/TIC-4585-R1-Suppl-1) Avail: NTIS HC A03/MF A01

This supplement contains additions to TID-4585-R1 and is intended to be used with that publication. Future supplements will be cumulative from June 1978 until another revision is issued. DOE

N80-10618# Department of Energy, Washington, D. C.
NATIONAL ENERGY PLAN 2

1979 355 p
 (DOE/TIC-10109) Avail: NTIS HC A16/MF A01

The Administration's second National Energy Plan is presented. The past, present, and future of energy supply and demand for the U.S. is discussed. DOE

N80-10619# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY TRANSITION IN CALIFORNIA

M. N. Christensen 1979 25 p refs
 (Contract W-7405-eng-48)
 (UCRL-15003) Avail: NTIS HC A02/MF A01

Major elements of consensus within current energy debates are discussed. Implications of that consensus for development of large scale supply facilities, decisions by end-users of energy, and prospects for future demands for energy are also discussed. Events and circumstances in California are focused but relevant information from other places is also used. DOE

N80-10620# Department of Energy, Washington, D. C.
**ENERGY SUPPLY AND DEMAND IN THE MIDTERM: 1985,
 1990, AND 1995 Analysis Report**

Apr. 1979 223 p
 (DOE/EIA-0102/52) Avail: NTIS HC A10/MF A01

To account for the uncertainty inherent in projecting future energy production, consumption, prices, and associated variables, five basic projection series (A-E) are presented. These series constitute variations in assumptions influencing energy supply and demand curves. High demand is assumed for Series A and B, and low demand is assumed for D and E. High supply is assumed for Series A and D, and low supply is assumed for Series B and E. Series C assumes medium supply and demand. Two additional scenarios, C High and C Low, evaluate the sensitivity of the Series C forecasts to variations in the projected

world of oil price. A computer model, called the 'midterm energy forecasting system', simulates the interactions of energy suppliers and consumers in the marketplace. DOE

N80-10621# California Univ., Berkeley. Lawrence Berkeley Lab.

ENERGY CONSERVATION AND THE ENVIRONMENT: CONFLICT OR COMPLEMENT

L. Schipper Sep. 1978 84 p refs Presented at Conf. on Impacts and Risks of Energy Strategies, Stockholm, Sweden, Sep. 1978 and the Environmental Secretariate, Organization for Economic Cooperation and Development, Paris, Oct. 1978 (Contract W-7406-eng-48)

(LBL-7882; Conf-7809141-1; Conf-7810167-1) Avail: NTIS HC A05/MF A01

The relationship among energy, the environment, and economic well-being is discussed. The confusing aspects were sorted out in order to show how goals relating to the efficient use of energy are aligned both with traditional economic goals and with modern environmental goals. The role of energy in the economy was analyzed and the origins of many of the misconceptions about that role were traced. DOE

N80-10623# California Univ., Livermore. Lawrence Livermore Lab.

METHODS OF ESTIMATING THE RELIABILITY OF WIND ENERGY SYSTEMS WITH STORAGE

C. R. Glassey and G. F. Moyer 1978 61 p refs (Contract W-7405-eng-48)

(UCRL-15005) Avail: NTIS HC A05/MF A01

Some preliminary results obtained in analyzing the reliability of wind generator storage systems are presented. The investigation took two separate approaches, simulation and probabilistic modeling, to reveal the trade-offs which can be made between generating capacity and storage capacity to attain a desired level of reliability. The performance criterion used throughout this work was the frequency of occurrence of empty storage. This criterion was essentially the same as the frequency of loss of load. DOE

N80-10624# Brookhaven National Lab., Upton, N. Y.
SOLAR ASSISTED HEAT PUMP OVERVIEW AND SUMMARY OF IN-HOUSE RESEARCH

John W. Andrews Sep. 1978 5 p refs Presented at the 3rd Ann. Solar Heating and Cooling R and D Contractors' Meeting, Washington, D.C., 24 Sep. 1978 (Contract EY-76-C-02-0016)

(BNL-24911; Conf-780983-2) Avail: NTIS HC A02/MF A01

The following areas of solar assisted heat pump research and development are overviewed: (1) development of special heat pump tuned to take advantage of the 40 to 100 F source temperature range appropriate for solar assist; (2) identification of low cost, solar energy collection and storage subsystems appropriate for the solar assist function; and (3) analysis of solar assisted heat pump systems to determine what component parameters are required to produce economically competitive systems. DOE

N80-10625# Battelle Pacific Northwest Labs., Richland, Wash.
METHODOLOGY FOR IDENTIFYING MATERIALS CONSTRAINTS TO IMPLEMENTATION OF SOLAR ENERGY TECHNOLOGIES

J. W. Litchfield, R. L. Watts, W. E. Gurwell, J. N. Hartley, and C. H. Bloomster Jul. 1978 91 p refs (Contract EY-76-C-06-1830)

(PNL-2711) Avail: NTIS HC A05/MF A01

A materials assessment methodology for identifying specific critical material requirements that could hinder the implementation of solar energy was developed and demonstrated. The methodology involves an initial screening process, followed by a more detailed materials assessment. The detailed assessment considers such materials concerns and constraints as process and production constraints, reserve and resource limitations, lack of alternative supply sources, geopolitical problems, environmental and energy concerns, time constraints, and economic constraints. Data for 55 bulk and 53 raw materials required in the example photovoltaic systems are available on the data base. Engineering and bulk

material requirements were defined for one photovoltaic system, thirteen photovoltaic cells, ten solar heating and cooling systems, and two agricultural and industrial process heat systems. DOE

N80-10626# Sandia Labs., Albuquerque, N. Mex.
SENSITIVITY STUDY OF BRAYTON CYCLE POWER PLANT PERFORMANCE

Carl C. Hiller Aug. 1978 36 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8020) Avail: NTIS HC A03/MF A01

The efficiency of Brayton cycle power plants is investigated. The parameters and configurations examined include open and closed air cycles, optimum pressure ratio, helium versus air working fluids, turbine and compressor isentropic efficiencies, recuperator effectiveness, turbine inlet temperature, heat rejection temperature, pressure drop losses, with/without intercooling, and with/without reheat. Equation derivations, a computer listing, and a hand calculator program listing are included. DOE

N80-10627# Oak Ridge National Lab., Tenn.
SURVEY OF SOLAR THERMAL ENERGY STORAGE SUBSYSTEMS FOR THERMAL/ELECTRIC APPLICATIONS

C. L. Segaser Aug. 1978 101 p refs

(Contract W-7405-eng-26)

(ORNL/TM-5758) Avail: NTIS HC A06/MF A01

The technology and estimated costs of subsystems for storing the thermal energy produced by solar collectors are discussed. The systems considered are capable of producing both electricity and space conditioning for a single family detached residence, an apartment complex of 100 units, and a city of 30,000 residents containing both single family residences and apartments. Up to 36 x 10 to the 5th power kWhr of thermal storage capacity is required. In addition to sensible heat and latent heat storage materials, several other media were investigated as potential thermal energy storage materials, including the clathrate and semicathrate hydrates, various metal hydrides, and heat storage based on inorganic chemical reactions. DOE

N80-10628# Public Service Electric and Gas Co., Newark, N. J.
BATTERY ENERGY STORAGE TEST (BEST) FACILITY Progress Report

Emile A. Hyman Feb. 1979 94 p refs

(Contract EY-76-C-02-2857)

(EPRI-EM-1005; PR-1) Avail: NTIS HC A05/MF A01

The activities of the first three phases during the time period March 1, 1976 to July 1, 1978 are presented. Included are a background review, key milestone dates, a description of activities for the three phases (including those associated with the future implementation of the second test bay), and a description of major interactions between the BEST Facility program and the advanced battery development programs. DOE

N80-10629# Mitre Corp., McLean, Va. Metrek Div.
ENVIRONMENTAL DATA FOR ENERGY TECHNOLOGY POLICY ANALYSIS. VOLUME 1: SUMMARY

Joke Verhoeff, Robert Kline, William L. Parker, Thomas F. Wolfinger, David Adler (CONSAD Research Corp.), Gabriel Sucher (CONSAD Research Corp.), Marc Narkus-Kramer (International Research and Technology, Inc.), Nicklaus E. Leggett (International Research and Technology, Inc.), and Tyrone Williams (International Research and Technology, Inc.) Jan. 1979 106 p refs (Contract EE-77-C-01-6119)

(HCP/EV6119-1) Avail: NTIS HC A06/MF A01

Qualitative and quantitative information on the environmental aspects of different energy technologies is provided. Data are given on nuclear energy, coal, synthetic fuels, oil shale, solar energy, geothermal energy, and hydroelectricity. Each category of technology is broken down into individual technology phases or base units for which environmental effects could reasonably be specified. Each base unit is described in terms of a typical unit or plant size and configuration. DOE

N80-10630# Department of Energy, Washington, D. C. Office of Program Coordinator.
COMPREHENSIVE ENVIRONMENT, HEALTH, AND SAFETY PROGRAM REPORT, FY 1978

Feb. 1979 67 p refs

(DOE/EV-0035) Avail: NTIS HC A04/MF A01

A description is given of the environment, health, and safety research, development, and demonstration activities carried out and in progress. Discussion is presented under the following section headings: a comprehensive environment, health, and safety program; concept and implementation approach; the DOE Office of Environmental - program and selected activities; environmental, health, and safety activities of other DOE offices; and, environmental, health, and safety activities of other Federal agencies. Titles of the four appendixes are: definition of research categories; summary of energy-related environment, health, and safety concerns; environment, health, and safety laws and regulations governing activities of the Department of Energy; and environmental, health, and safety activities of Federal agencies participating in the Federal Inventory. DOE

N80-10631# Department of Energy, Washington, D. C. Div. of Technology Assessments.

ENVIRONMENTAL READINESS OF EMERGING ENERGY TECHNOLOGIES Summary Report

Jan. 1979 77 p

(DOE/ERD-0022) Avail: NTIS HC A05/MF A01

The principal conclusions of the 21 Environmental Readiness Documents, which assessed 24 technologies are presented. Seven technologies were judged to have minimal environmental constraints. Four are solar technologies. The minimally constrained technologies nevertheless have some potential environmental, health, and safety problems, which will require careful management. Eleven technologies, many of which are high-technology systems with great promise for meeting the Nation's energy needs, were judged to have moderate environmental constraints. The moderately constrained technologies are, with few exceptions, in the predemonstration stage, with demonstration and environmental readiness likely to be achieved by 1980-1990. Six technologies, enhanced oil recovery (micellar polymer), hydrothermal, coal gasification, coal liquefaction, diesel cogeneration, and in situ oil shale, were judged to have significant environmental constraints that will require extensive environmental research and development before they can be widely used or before they can be deployed in some environmentally sensitive areas. DOE

N80-10633# Brookhaven National Lab., Upton, N. Y.
DYNAMICS AND CONTROL: ENERGY CONVERSION, DELIVERY, AND DEMAND ANALYSIS

Kenneth C. Hoffman Apr. 1979 22 p refs Presented at the Workshop on Process and Systems Dyn. Control, Denver, 20 Jun. 1979

(Contract EY-76-C-02-0016)

(BNL-26045; Conf-790636-1) Avail: NTIS HC A02/MF A01

Techniques of mathematical modeling and modern control theory, using microprocessors and advanced measurement and control devices, are extensively applied to components and systems for the conversion and delivery of energy. The projection of energy demands, as a function of economic growth and energy price, is also the subject of active research and analysis. This position paper reviews the current state-of-the-art of analysis in these areas dealing with the planning and operation of energy systems that deliver fuels and electric power. Future research directions are also discussed. DOE

N80-10634# RAND Corp., Santa Monica, Calif.

SOVIET ENERGY BALANCES

Robert Campbell Dec. 1978 115 p refs

(Contract EX-76-C-01-2337)

(RAND/R-2257-DOE) Avail: NTIS HC A06/MF A01

The pattern of energy flows in the Soviet economy contrasts sharply with that in the U.S. and in Western Europe. Today, the flow of energy exports in the USSR amounts to about 12% of Soviet primary energy production in 1975, whereas the U.S. and Western Europe must rely heavily on imports to augment domestic production. The composition of primary energy production in the USSR has changed considerably since 1950, when 80% was accounted for by solid fuel and only 18.5% by hydrocarbons. By 1975, hydrocarbons accounted for 64%, and the share for solid fuels had fallen to 33%. Since most Soviet

energy exports have consisted of oil, the emphasis on solid fuels in consumption in the USSR is still higher than in production: solid fuels now represent 37% of consumption compared with 21% in Western Europe and 19% in the U.S. Within solid fuels, there is heavy reliance on relatively low-grade fuels: lignite, peat, oil shale, and firewood constituted nearly a third of Soviet solid fuel production in 1975. DOE

N80-10635# Washington Scientific Marketing, Inc., Washington, D. C.

DEPARTMENT OF ENERGY WORKSHOPS ON INDUSTRIAL ENERGY CONSERVATION REPORTING Final Report

[1979] 190 p Workshops held at Washington, D. C., Atlanta, Houston, Tex., Chicago, New York, San Francisco, Nov. 1978 - Feb. 1979

(DOE/CS-1830-T3) Avail: NTIS HC A09/MF A01

A voluntary industrial energy-conservation program was initiated and now includes 50 trade organizations representing over 3,000 companies. Their current reporting system is an effort to respond to the Energy Policy and Conservation Act requirements, as now modified by the National Energy Conservation Policy Act. DOE's Office of Industrial Programs held six workshops in various key locations between November 1978 and February 1979 to enable energy managers to develop ideas and make suggestions that would improve the current and future energy-reporting programs. This report is a summary of the wide range of recommendations that the workshop participants offered as a means of meeting the NECPA requirements and the criticism of the current reporting program. It also reflects industry's views on potential approaches to future reporting. DOE

N80-10636# RAND Corp., Santa Monica, Calif.

RESOLVING ENVIRONMENTAL ISSUES IN ENERGY DEVELOPMENT: ROLES FOR THE DEPARTMENT OF ENERGY AND ITS FIELD OFFICES

Phyllis L. Ellickson and Edward W. Mellow Jan. 1979 62 p refs

(Contract EX-76-C-01-2337)

(RAND/R-2335-DOE) Avail: NTIS HC A04/MF A01

The role of the Department of Energy to resolve environmental conflicts that arise during the implementation of energy projects or programs was studied. The environmental concerns surrounding implementation and feasibility of national energy policies were also studied. The investigation reached the conclusion that the government's most effective role in resolving environmental conflicts and uncertainties is to improve communications among the concerned parties. This role requires flexibility and evenhandedness from the government as well as an understanding of the local conditions and a commitment to appropriate local solutions. Involving local sources at every stage of the environmental impact analysis can reduce the probability of conflicts and make those that do arise more easily resolvable. DOE

N80-10637# Los Alamos Scientific Lab., N. Mex.

SELECTED RESULTS FROM THE TECHNOLOGY ASSESSMENT OF SOLAR ENERGY PROGRAM

Milton C. Krupka and John H. Altseimer 1979 8 p refs Presented at AIAA Terrestrial Energy Systems Conf., Orlando, Fla., 4-6 Jun. 1979

(Contract W-7405-eng-36)

(LA-UR-79-950; Conf-790611-3)

Avail: NTIS

HC A02/MF A01

Emerging solar technologies and selected applications were studied from environmental, institutional and social viewpoints. The impacts resulting from the large scale deployment of decentralized solar technologies were assessed. Emphasis was placed upon technical characterization of the technology and the development of a representative model system for a given application upon which an environmental analysis could be made. DOE

N80-10638# Sandia Labs., Albuquerque, N. Mex.

ANALYTICAL EVALUATION OF A SOLAR THERMOPHOTVOLTAIC (TPV) CONVERTER

Michael W. Edenburn 1979 5 p refs Presented at the International Solar Energy Society Meeting, Atlanta, 28 May 1979

(Contract EY-76-C-04-0789)

(SAND-79-0504C; Conf-790541-2)
HC A02/MF A01

Avail: NTIS

A thermophotovoltaic converter was parametrically analyzed for emitter temperature, cell reflectance to radiation with energy below the cell's bandgap energy and concentration ratio requirements. Important conclusions are: (1) an emitter temperature of 2000 K is optimal; (2) a cell reflectance value of 0.98 is required for below bandgap irradiation; (3) a secondary concentrator must be used with a parabolic dish primary; and (4) a mirror quality resulting in a 4 mrad reflection-beam dispersion is required for a 24% conversion efficiency. DOE

N80-10639# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR SOLAR PHOTOVOLTAIC APPLICATIONS

Alan R. Millner 1979 9 p Presented at the ASME Gas Turbine Conf., San Diego, Calif., 12-15 Mar. 1979

(Contract EY-76-C-02-4094)

(COO-4094-31; Conf-790305-6)

Avail: NTIS

HC A02/MF A01

A low-drag, low-power magnetic bearing and a permanent magnet brushless DC motor-generator developed were developed for a satellite flywheel. These will be combined with a terrestrial flywheel and control electronics to make up a flywheel energy storage and conversion system for use in a stand-alone solar photovoltaic residence. Technical and economic performance analyses indicate that, contrary to general thought, a flywheel system will be competitive if not superior to more conventional systems utilizing either present day or advanced batteries. This derives from the ability of the flywheel to perform the functions of dc-to-ac inversion and optimal impedance matching between the PV arrays and the load in addition to providing energy storage. The structural topology, performance data, design parameters, and test measurements of the magnetic bearing and motor-generator are to be used as well as the flywheel and control electronics. A preliminary discussion of the economic aspects is also included. DOE

N80-10640# Sandia Labs., Albuquerque, N. Mex.
GRAPHICAL REPRESENTATION OF TMY SOLAR RADIATION AVAILABILITY FOR ONE- AND TWO-AXIS SOLAR COLLECTORS

L. L. Lukens and R. R. Peters May 1979 113 p refs

(Contract EY-76-C-04-0789)

(SAND-79-0418) Avail: NTIS HC A06/MF A01

Information about the availability of direct normal radiation to three tracking modes of concentrating collectors (two-axis, east-west, and north-south horizontal axis tracking collectors) for the 26 typical meteorological year stations is presented. The data presented include energy availability, efficiency based on the direct normal radiation availability, and energy distribution. DOE

N80-10644# Department of Energy, Washington, D. C. Div. of Legislative Research and Analysis.

SUMMARY OF MAJOR ENERGY LEGISLATION OF THE 95TH CONGRESS

Dec. 1979 158 p

(DOE/TIC-10118) Avail: NTIS HC A08/MF A01

The title, sponsor, synopsis, and legislative status of major energy legislation of the 95th Congress includes the following subjects: Alaska lands, Alaska gas transportation, antiboycott legislation, backhauling, Canadian fuel imports, cargo preference/tanker safety, Clean Air Act, coal conversion, coal leasing, coal slurry pipelines, cogeneration, dealer protection, Department of Energy (organization), DOE FY-79 appropriations and authorizations, divestiture, electric energy and utilities, energy conservation, energy impact assistance, Energy Policy Institute, ERDA FY-78 authorizations, ERDA/FEA FY-78 appropriations, enhanced oil recovery, environment and safety, FEA FY-78 authorization, fuels transportation safety, gasohol, geothermal energy, insulation standards, liquefied natural gas, mine safety, National Energy Act, natural gas, nuclear energy, nuclear siting and licensing, nuclear waste management, oil and gas leasing, oil import fees, oil pollution liability, oil shale commercialization, outer continental

shelf, pipeline destruction, Safe Drinking Water Act, solar energy, state energy management program, strip mining, and uranium mill tailings. DOE

N80-10645# Los Alamos Scientific Lab., N. Mex.
ECONOMIC PERFORMANCE OF PASSIVE SOLAR HEATING: A PRELIMINARY ANALYSIS

Fred Roach, Scott Noll (New Mexico Univ., Albuquerque), and Shaul Ben-David 1978 11 p refs Presented at AIAA/ASERC Conf. on Solar Energy, Phoenix, Arizona, 27-29 Nov. 1978

(LA-UR-78-2861; Conf-781133)

Avail: NTIS

HC A02/MF A01

For the thermal storage wall two types of storage medium-masonry (Trombe) and water are examined. In addition, a night insulation option is included in the thermal storage wall concept, thus giving rise to four alternative passive designs. The economic performance of these alternative designs is evaluated on a state-by-state basis. The architectural design criteria, solar performance characteristics, and the incremental solar cost of each solar design are reviewed. Conventional energy costs are discussed as well as the optimal sizing/feasibility criterion employed in the economic performance analysis. Nationwide feasibility results are reviewed for each alternative design. In addition to contracting the solar systems themselves, the effects of two incentive proposals-the National Energy Act (NEA) income tax credits and low interest loads-upon each design are examined. Major conclusions are summarized for each design. DOE

N80-10646# Notre Dame Univ., Ind. Dept. of Electrical Engineering.

OPTIMAL CONTROL STUDIES OF A SOLAR HEATING SYSTEM

M. Somasundaram, James L. Melsa, and Donald R. Farris 1978 6 p refs Presented to IEEE Midcom on Electron., Dallas, Tex., 13 Dec. 1978

(Contract W-7405-eng-36)

(LA-UR-78-2556; Conf-781208)

Avail: NTIS

HC A02/MF A01

Performance bounds were established for a heating, ventilating and air conditioning system in a solar heated and cooled building. Perfect knowledge of environmental conditions such as ambient temperature, wind velocity and insulation was assumed in order to determine whether prior knowledge of such information can be effectively employed to reduce the amount of auxiliary energy used. The optimal control study is based on a model of the 660000 sq. ft. National Security and Resources Study Center at the Los Alamos Scientific Laboratory. DOE

N80-10650# Sandia Labs., Albuquerque, N. Mex.
DETERMINATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF LUMINESCENT SOLAR CONCENTRATORS Final Report

C. F. Rapp, N. L. Boling, I. M. Thomas, G. L. Opdycke, R. B. Fechter, J. Chrysochoos, and P. S. Friedman Mar. 1979 213 p refs

(Contract EY-76-C-04-0789)

(SAND-79-7005) Avail: NTIS HC A10/MF A01

A somewhat different concentrator configuration was investigated. In the configuration, a thin luminescent film is deposited on all undoped substrate. The luminescence then originates in the film but is trapped within the entire thicker structure. In this study, a large number of fluorescent dopant-host combinations were identified. These were primarily organic but inorganic materials were also included. Absorption spectra, emission spectra and quantum efficiencies were measured on various samples in order to identify the best candidates for the luminescent concentrator device. Six inch by six inch and twelve inch by twelve inch concentrator plates were made which demonstrated approximately 15% effective concentrator efficiencies. The major loss mechanisms responsible for decreases in collector efficiencies were identified and quantitatively evaluated. Efficiency improvement factors of several times appear possible. DOE

N80-10651# Brookhaven National Lab., Upton, N. Y.
STATE OF THE ART OF SENSIBLE HEAT STORAGE FOR SOLAR HEAT PUMP SYSTEMS

Philip D. Metz 1979 9 p refs Presented to Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979 (Contract EY-76-C-02-0016)

(BNL-25909; Conf-790328-4) Avail: NTIS HC A02/MF A01

Factors which influence the storage characteristics of solar source heat pump systems are discussed including: solar collection devices, the heat pump, and the utility interface. Some of the characteristics of solar source heat pumps storage are specified such as: temperature range and thermal inertia. The storage options which are discussed are: rock beds, water tanks, ground coupled storage, swimming pools, and ponds. DOE

N80-10652# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

ANALYSIS OF A LICI OPEN-CYCLE ABSORPTION AIR CONDITIONER WHICH UTILIZES A PACKED BED FOR REGENERATION OF THE ABSORBENT SOLUTION DRIVEN BY SOLAR HEATED AIR Final Report, Dec. 1977 - Sep. 1978

Cecile M. Leboeuf and G. O. G. Loef Oct. 1978 32 p refs (Contract EG-77-S-02-4546)

(COO-4546-1) Avail: NTIS HC A03/MF A01

The technical feasibility of lithium chloride open cycle absorption air conditioner which utilizes solar heated air for reconcentration of the absorbent solution is examined. The use of a packed bed concentrator was described. Operating conditions for a 3-ton residential unit are determined from equilibrium data, conservation of mass and energy, and transfer rate equations. Humidity, air temperature, and packing type are varied to determine their effect on packed bed performance and required packing volumes. The required operating temperatures, humidities, and flow rates are comparable to those which can be obtained from a conventional solar air-heating system during the summer, especially in dry climates. Construction and testing of a packed bed of appropriate design is recommended for validation of the analysis. DOE

N80-10653# Colorado State Univ., Fort Collins. Solar Energy Applications Labs.

PRELIMINARY ANALYSIS OF A TOTAL SOLAR HEATING SYSTEM Final Report, Dec. 1977 - Sep. 1978

James A. Leflar, P. Burns, and C. B. Winn Oct. 1978 28 p (Contract EG-77-S-02-4546)

(COO-4546-4) Avail: NTIS HC A03/MF A01

A set of computer simulation programs was developed such that the programs provide a useful design tool for the design of total solar heating systems. DOE

N80-10654# Carrier Corp., Syracuse, N. Y. Energy Systems Div.

DEVELOPMENT OF A HIGH TEMPERATURE SOLAR POWERED WATER CHILLER. VOLUME 3: PHASE 1 Technical Progress Report, 26 Sep. 1977 - 1 Jun. 1978

Richard A. English Jun. 1978 121 p refs

(Contract EG-77-C-03-1590)

(SAN-1590-1/3-Vol-3) Avail: NTIS HC A06/MF A01

The conceptual design rationale and resulting design configuration are described as well as estimates of cost and performance. Because the development of the turbocompressor design paralleled the development of the chiller system design, all of the cost and performance data are based on intermediate turbo-compressor performance data, as well as on unoptimized components. Optimized performance was computed. DOE

N80-10655# Alabama Univ., Huntsville.
EXPERIMENTAL AND NUMERICAL STUDIES OF LIQUID STORAGE TANK THERMAL STRATIFICATION FOR A SOLAR ENERGY SYSTEM Semiannual Progress Report, 1 Mar. - 31 Aug. 1978

S. T. Wu 29 Sep. 1978 24 p

(Contract EG-77-S-02-4479)

(COO-4479-2) Avail: NTIS HC A02/MF A01

The construction of the thermal stratification system was completed and checked out. The details of this check-out procedure are included. The physical dimensions of the facility are shown. This storage tank is a modified septic tank with a capacity of 1500 gallons. This tank is installed with approximately half of the tank below ground. Insulation is 3 in of spray-on foam externally and 1 in internally, protected by a butyl rubber covering. The liquid level in the tank is 44 in. DOE

N80-10656# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

SOLAR GENERATION OF INDUSTRIAL STEAM. INNOVATIVE RESEARCH PROGRAM SUBTASK Final Report, Dec. 1977 - Sep. 1978

Terry Lenz Oct. 1978 10 p refs

(Contract EG-77-S-02-4546)

(COO-4546-9) Avail: NTIS HC A02/MF A01

Comparison of hybrid solar-mechanical (vaporization at low pressure followed by compression), inorganic salt eutectic and polymer latent heat slurry, and solar-thermochemical schemes, pointed to the thermochemical approach as most promising. The condensed-phase reactions were studied. The following classes of reactions meet the set of criteria: reversibly-catalyzed thermal isomerizations, Diels-Alder additions, and esterifications. These particular reaction classes offer significant potential for lower temperature solar-thermochemical systems with condensed phase energy storage. DOE

N80-10657# PRC Energy Analysis Co., Los Angeles, Calif.

SATELLITE POWER SYSTEM (SPS) PRELIMINARY SOCIETAL ASSESSMENT

Charles Bloomquist, A. Daurio, and S. Shotland May 1979 69 p refs

(Contract EG-77-C-01-4024)

(HCP/R4024-01/14) Avail: NTIS HC A04/MF A01

The findings of fourteen papers dealing with SPS societal issues are presented. While numerous societal problems and potential concerns are delineated, no program stoppers were identified. Thus, in so far as the societal ramifications of an SPS are concerned, additional study of the concept is warranted. Societal topics which merit particular attention in the future are delineated. These include rectenna site availability, utility integration, and institutional/international considerations. Study findings that might be used in a comparative assessment of the SPS with alternative energy systems are presented. Methodological considerations for future SPS societal research are also discussed. DOE

N80-10658# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

COST-EFFECTIVE CONTROL SYSTEMS FOR SOLAR HEATING AND COOLING APPLICATIONS Final Report

Jane H. Pejsa, W. W. Bassett, S. A. Wenzler, K. H. Nguyen, and T. J. Olsen Sep. 1978 180 p refs

(SAN-1592-1) Avail: NTIS HC A09/MF A01

A methodology is defined and the results are presented to arrive at control recommendations for a variety of climate control system designs, applications and regions, strategies, functions, sensors, actuators, and the controllers themselves. The bulk of the study effort - an attempt to simulate and evaluate system performance for several representative residential and commercial heating and cooling designs and thus to derive improved performance techniques within cost-effective control systems - are discussed. DOE

N80-10659# International Business Machines Corp., Huntsville, Ala.

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: A-FRAME INDUSTRIES, SINGLE FAMILY DWELLING, KANEOHE, HAWAII Progress Report, Feb. - Sep. 1978

D. L. Nemetz 1978 29 p refs

(Contract EG-77-C-01-4049)

(SOLAR/1010-78/14) Avail: NTIS HC A03/MF A01

The operation of the solar energy system is summarized. This system is designed to provide domestic hot water for a single family dwelling in Kaneohe, Hawaii. Measured system

performance is evaluated and measured climatic data are compared with long term average conditions. Performance evaluations of each major subsystem are also presented. DOE

N80-10660# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.

OPTIMAL INSULATION OF PIPES AND TANKS FOR SOLAR HEATING SYSTEMS

Gerard F. Jones and N. Lior Feb. 1979 75 p refs

(Contract EM-78-C-04-5319)

(ALO-5319-2) Avail: NTIS HC A04/MF A01

A compact and time effective insulation design procedure for solar heating system piping and water-filled thermal storage tanks was developed. Recognizing the particular sensitivity of solar systems to cost, the economic aspect of the problem is treated by a comprehensive present-value life-cycle cost analysis. In the development of the method, a numerical sensitivity analysis was performed to determine the relative effects of all relevant independent variables (within their pertinent ranges) on piping and tank heat transfer coefficient values. DOE

N80-10661# Idaho National Engineering Lab., Idaho Falls. **OVERVIEW OF GEOTHERMAL ENERGY IN THE UNITED STATES**

Robert J. Schultz and E. G. DiBello 1 May 1979 14 p refs Presented at the Energy Conserv. Symp., San Francisco, 1 May 1979

(Contract EY-76-C-07-1570)

(Conf-790530-1) Avail: NTIS HC A02/MF A01

The development of hydrothermal resources, hot igneous rock resources, and conduction dominated resources is reviewed. Geothermal power generation and direct applications in the U.S. are discussed. DOE

N80-10662# Westinghouse Research and Development Center, Pittsburgh, Pa.

PERFORMANCE MONITORING OF AN OFF-PEAK HEATING AND COOLING SYSTEM UTILIZING THERMAL STORAGE AND SOLAR AUGMENTED HEAT PUMP

W. C. Moreland Apr. 1979 39 p

(EPRI-ER-845) Avail: NTIS HC A03/MF A01

The instrumentation system (including sensors and data logging equipment) used in the demonstration system are described. A general description is also given of the modes of operation of the main heat pump/storage/solar system, the proposed methodology and format for data reduction, and the present status of the program. DOE

N80-10663# Midwest Research Inst., Golden, Colo.

SOLAR POND CONCEPTS: OLD AND NEW

T. S. Javadev, Michael Edesess, and Jon Henderson 1979 7 p refs Presented at the 14th Intersoc. Energy Conversion Eng. Conf., Boston, 5-10 Aug. 1979

(Contract EG-77-C-01-4042)

(SERI/TP-35-208; Conf-790803-3)

Avail: NTIS HC A02/MF A01

Different types of solar ponds were considered from the early 1900s to the present. Salty ponds use salt to create a nonconvecting pond. Shallow solar ponds were investigated by Shuman and Willsie in 1906 and 1907 and are currently being studied by Lawrence Livermore Laboratories. Swedish investigators are studying a combination of solar collectors and water storage in a pond-cover configuration. In addition, there are thermoclines created in large bodies of water, as in large reservoirs. The various types of solar ponds are surveyed and the best of the ideas are combined to synthesize new concepts. A new solar pond concept is presented which combines the good features of convecting and nonconvecting (salty) ponds. DOE

N80-10664# California Univ., Livermore. Lawrence Livermore Lab.

EFFECT OF MECHANICAL ENERGY STORAGE SYSTEMS ON THE CHARACTERISTICS OF ELECTRIC VEHICLES

Martin W. Schwartz 14 May 1979 7 p Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979; Sponsored by the Am. Chem. Soc.

(Contract W-7405-eng-48)

(UCRL-82710; Conf-790803-17)

HC A02/MF A01

Avail: NTIS

Batteries for electric vehicle propulsion were investigated to see if effective trade-offs between short term peak power capability and energy storage capacity are possible. It was found that batteries in combination with a mechanical energy storage device can optimize both power and range capability of an electric vehicle. Equations were derived for determining the vehicle mass fraction of the mechanical energy storage system that is required to achieve a vehicle mass saving or increase in range. The extent to which mechanical energy storage systems can improve electric vehicle performance was found to depend upon the battery type and the vehicle power/mass requirements. DOE

N80-10665# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.

WASTE HEAT UTILIZATION: PROCEEDINGS OF 1978 ENGINEERING FOUNDATION CONFERENCE

Apr. 1979 327 p refs Conf. held at Henniker, N. H., 13-18 Aug. 1978

(CONF-7808102) Avail: NTIS HC A15/MF A01

Fifteen papers are presented containing engineering concepts, improved methods, and/or equipment descriptions pertaining to waste heat utilization. R.E.S.

N80-10667# New Mexico Univ., Albuquerque.

WASTE UTILIZATION AS AN ENERGY SOURCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979

Gerald F. Zollars Jul. 1979 55 p

(NTIS/PS-79/0765/2) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 21D

Articles from the international literature concerning the processing of solid and organic wastes for use as an energy source are cited. Industrial agricultural, and residential wastes are considered as sources of both gaseous and liquid fuels such as methane, methanol, ethanol, and synthane. This bibliography contains 219 entries. GRA

N80-10668# New Mexico Univ., Albuquerque. Technology Application Center.

AIRCRAFT FUEL. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1979

Gerald F. Zollars Jul. 1979 43 p Sponsored in part by NTIS, Springfield, Va.

(NTIS/PS-79/0764/5) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 10A

These 160 citations concern means to conserve fuel in airline operations. Articles dealing with aircraft design, fuels, engine design, propulsion efficiency, and operating procedures which conserve fuel are included. GRA

N80-10674# National Technical Information Service, Springfield, Va.

MICROWAVE HEATING: INDUSTRIAL APPLICATIONS. CITATIONS FROM THE ENGINEERING DATA BASE Progress Report, 1970 - May 1979

William E. Reed Jul. 1979 209 p Supersedes NTIS/PS-78/0572; NTIS/PS-77/0515; NTIS/PS-76/0447

(NTIS/PS-79/0632/4; NTIS/PS-78/0572; NTIS/PS-77/0515; NTIS/PS-76/0447) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 13A

Industrialized uses of microwave heating are covered in these citations of worldwide research. The topics include industrial heating and drying for processes such as paper drying, vulcanization, and textile processing. Equipment design and safety are also cited. This updated bibliography contains 203 abstracts, 29 of which are new entries to the previous edition. GRA

N80-10677# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Nuclear and Alternative Energy Systems.

GEOHERMAL RESOURCES AND TECHNOLOGY IN THE UNITED STATES

Feb. 1979 65 p refs
(PB-296623/2; ISBN-0-309-02874-4) Avail: NTIS
MF A01; HC National Academy of Science, Washington, D. C.,
\$5.50 CSCL 10B

The potentials and problems of geothermal energy are assessed with particular focus on current obstacles in the development of the geothermal industry. GRA

N80-10678# General Accounting Office, Washington, D. C. Energy and Minerals Div.

ENERGY SAVING STRATEGIES FOR FEDERAL PROCUREMENT

19 Jun. 1979 14 p
(PB-296969/9; EMD-79-68) Avail: NTIS HC A02/MF A01
CSCL 10A

Federal energy conservation measures are evaluated, and what Federal agencies have done to develop and implement procurement techniques which result in reduced energy consumption is reviewed. GRA

N80-10679# General Accounting Office, Washington, D. C. Energy and Minerals Div.

NATURAL GAS RESERVES ESTIMATES: A GOOD FEDERAL PROGRAM EMERGING, BUT PROBLEMS AND DUPLICATIONS PERSIST

15 Jun. 1979 85 p
(PB-296628/2; EMD-78-68) Avail: NTIS HC A05/MF A01
CSCL 10A

Improvements needed in the Government's efforts to estimate the Nation's natural gas reserves are discussed. GRA

N80-10681# National Technical Information Service, Springfield, Va.

LEAD BATTERIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jul. 1979

Diane M. Cavagnaro Aug. 1979 121 p refs Supercedes
NTIS/PS-78/0690; NTIS/PS-77/0634; NTIS/PS-76-0550
(NTIS/PS-77/0634; NTIS/PS-76/0550; NTIS/PS-79/0782/7;
NTIS/PS-78/0690) Avail: NTIS HC \$28.00/MF \$28.00 CSCL
10C

Worldwide research on lead battery components, charging, corrosion, and testing is cited. The majority of studies concern battery use in electric vehicles. Studies on lead recovery from battery scrap and air pollution at battery factories are also included. This updated bibliography contains 115 abstracts, 59 of which are new entries to the previous edition. GRA

N80-10683# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

FLUID DYNAMIC ASPECTS OF WIND ENERGY CONVERSION

O. DeVries (Natl. Aerospace Lab., Amsterdam) Jul. 1979
145 p refs
(AGARD-AG-243; ISBN-92-835-1326-6) Avail: NTIS
HC A07/MF A01

The theory of horizontal axis and vertical axis wind driven turbines is discussed. Inhomogeneous flow, turbulence effects, turbine control, wake interference effects, and wind concentrator concepts are surveyed. K.L.

N80-10688# California Univ., Livermore. Lawrence Livermore Lab.

THE IMPACT OF LNG SPILLS ON THE ENVIRONMENT: A COMPARISON OF DISPERSION MODELS AND EXPERIMENTAL DATA

B. R. Bowman, S. B. Sutton, and W. J. Comfort 9 Jan. 1979
6 p refs Presented at the 19th Ann. Meeting of the Inst. of Environ. Sci., Seattle, 29 Apr. - 2 May 1979
(Contract W-7405-eng-48)

(UCRL-81812; Conf-790445-1) Avail: NTIS
HC A02/MF A01

Two dispersion model calculations are compared with experimental data collected for 5-cubic-meter spills of liquefied natural gas (LNG) on water. The models are a Gaussian dispersion model, which includes models for vapor generation and gravity spread, and a three dimensional solution of the compressible turbulent transient Navier-Stokes equations and associated equations for conservation of species and energy. The latter model was also run in a two dimensional mode to evaluate the utility of two dimensional calculations. These calculations are compared to data collected in LNG spill and dispersion experiments, which measured the concentration of hydrocarbons at several downwind locations. The adequacy of the models and differences between them are discussed. Areas for model improvement are indicated. DOE

N80-10689# Computer Genetics Corp., Wakefield, Mass. REMOTE SENSING OF LNG SPILL VAPOR DISPERSION USING RAMAN LIDAR

D. A. Leonard and B. Caputo Mar. 1979 121 p
(Contract W-7405-eng-48)
(UCRL-13984) Avail: NTIS HC A06/MF A01

A field experiment which evaluated the remote sensing of hydrocarbon concentrations in the dispersing cloud of gas produced by a spill of LNG using a Raman LIDAR technique is described. The background and objectives of the effort; a description of the lidar equipment; a description of the test site and the test scenario; and sections on data analysis and recommendations are included. DOE

N80-10692# Decision Focus, Inc., Palo Alto, Calif.

PROPOSED RESEARCH PLANNING FORMAT FOR THE ENVIRONMENTAL ASSESSMENT DEPARTMENT Final Report

D. Cohan and D. W. North Mar. 1979 127 p refs Sponsored by Electric Power Research Inst.

(EPRI-EA-1018; TPS-78-798) Avail: NTIS HC A07/MF A01
Issues of concern to Environmental Assessment Department (EAD) clients are reviewed, and alternative roles for EAD research are defined. The proposed planning format describes explicitly the steps in the planning and research process: identifying broad needs of industry and society; defining specific forcing issues; detailing research needs and objectives; developing research programs and projects; and producing the research results and integrated products that form the EPRI response to the original needs. An illustrative application of the planning format to the current EAD research program is included. DOE

N80-10693# Oak Ridge National Lab., Tenn. Energy Div. SOCIOECONOMIC DATA REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT: COAL GASIFICATION AND LIQUEFACTION PROJECTS

R. Steven Konkell 1978 28 p refs Presented at the Conf. on Net Energy Anal. and Energy Modeling, Colorado Springs, 21 Aug. 1978
(Contract W-7405-eng-26)

(CONF-780843-5) Avail: NTIS HC A03/MF A01

The development of data bases and monitoring programs will allow (1) identification of baseline conditions and existing levels of stress in the environment; (2) prediction of the potential impacts of construction, operation, and decommissioning of a coal conversion complex at a specific site; (3) determination of whether these or unanticipated impacts actually occur during these periods; and (4) evaluation of the effectiveness of mitigation measures designed to lessen adverse impacts on the environment. Socioeconomic data requirements include characterization of land uses, land-use management alternatives, demography and employment, economic and fiscal indicators, and infrastructure capacities for site-specific study areas. The monitoring program should be designed to identify appropriate study areas, and incorporate input from citizen groups and local planning officials. Author

N80-10694# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMENTAL IMPLICATIONS FOR GEOTHERMAL ENERGY DEVELOPMENT

N80-10700

Robert B. Craig and Glenn W. Suter, II 1979 8 p refs
Presented to the Inst. of Environ. Sci., Seattle, Wash., 29 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790445-3) Avail: NTIS HC A02/MF A01

The nature of hydrothermal, hot dry resources and the constraints that site characteristics place on their development are discussed. Effects on cultural, aesthetic, and wildlife resources are considered. DOE

N80-10700# Water Purification Associates, Cambridge, Mass. WASTEWATER TREATMENT IN COAL CONVERSION Final Report, Oct. 1976 - Jan. 1979

R. E. Hicks, D. J. Goldstein, F. B. Seufert, and I. W. Wei Jun. 1979 287 p refs

(Contract EPA-68-03-2207)

(PB-297587/8; EPA-600/7-89-133)

Avail: NTIS

HC A13/MF A01 CSCL 07A

Water treatment control technology specific to fuel conversion plant sites in the western U.S. is described. Most plants converting coal to other fuels use a large quantity of clean water (as stream) and put out a large quantity of dirty water that is condensed when the products from the coal reactor are cooled. Procedures for removing phenolic compounds are discussed: they include distillation, extraction, and adsorption. Design equations, step-by-step design procedures, and calculations for a typical unit are included along with physical data that are required for design. GRA

N80-10701# Mitre Corp., McLean, Va. Metrek Div. HEALTH AND ENVIRONMENTAL EFFECTS OF COAL GASIFICATION AND LIQUEFACTION TECHNOLOGIES: A WORKSHOP SUMMARY AND PANEL REPORTS Final Report

Richard Brown, ed. and Alice Witter, ed. May 1979 374 p
Workshop held at Leesburg, Va., Aug. 1978

(Contract DE-AC01-79EV-10018)

(PB-297618/1; MTR-79W00137; DOE/HEW/EPA-03) Avail:
NTIS HC A16/MF A01 CSCL 06F

Responses to President Carter's directive to identify health and environmental problems associated with advanced energy technologies are presented. The highlights of the issues and the detailed information requirements identified by panels of a workshop held in Leesburg, Virginia in August 1978 to address the health and environmental effects of coal gasification and liquefaction technologies are presented. The purposes of the workshop were to: (1) assemble multidisciplinary of biomedical and environmental scientists to address current developments in these technologies, (2) review and identify specific health and environmental issues and problems associated with their development and commercialization, and (3) consider research strategies required to address them and to identify requisite information needs for resolving uncertainties of assessing the relevant impacts of coal gasification and liquefaction technologies. The six panels of the workshop were: occupational and public health and safety; air quality; water quality, water quantity, and aquatic ecology; terrestrial effects; ambient measurement and monitoring; and source characterization. Panel reports containing specific information on environmental and health effects, information requirements, and detailed research statements are included in this report. GRA

N80-10709* National Aeronautics and Space Administration, Pasadena Office, Calif.

BOREHOLE GEOLOGICAL ASSESSMENT Patent

William H. Spuck, III, inventor (to NASA) (JPL) Issued 11 Sep. 1979 10 p Filed 4 May 1978 Supersedes N79-19521 (17 - 10, p 1306) Sponsored by NASA

(NASA-Case-NPO-14231-1; US-Patent-4,167,111;

US-Patent-Appl-SN-903019; US-Patent-Class-73-155;

US-Patent-Class-175-78) Avail: US Patent and Trademark Office CSCL 08G

A method and apparatus are discussed for performing geological assessments of a formation located along a borehole, and a boring tool that bores a pair of holes into the walls of the borehole and into the surrounding strata along with a pair of probes which are installed in the holes. One of the probes applies an input such as a current or pressured fluid, and the other probe senses a corresponding input which it receives from the strata. Official Gazette of the U.S. Patent and Trademark Office

N80-10918# Argonne National Lab., Ill.

POWER SUPPLY REQUIREMENTS FOR A TOKAMAK FUSION REACTOR

Jeffrey N. Brooks and Robert L. Kustom Feb. 1979 63 p refs

(Contract W-31-109-eng-38)

(ANL/FPP/TM-119) Avail: NTIS HC A04/MF A01

A system approach combining models of the reactor and poloidal coil set, plasma burn cycle and MHD calculations, and power supply characteristics and cost data was used to determine power supply requirements for a 7-M major radius commercial reactor. A conventional system using an MGF set and solid-state rectifier/inverter power supplies was studied in addition to systems using a homopolar generator, superconducting energy storage inductor, and dump resistors. The requirements and cost of the power supplies depend on several factors but most critically on the ohmic heating ramp time used for startup. Long ramp times (approximately > 85) seems to be feasible, from the standpoint of resistive voltsecond losses, and would appear to make conventional systems quite competitive with nonconventional ones, which require further research and development. DOE

N80-10922# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.

ONE- AND TWO-DIMENSIONAL HEATING ANALYSES OF FUSION SYNUEL BLANKETS

J. S. K. Tsang, O. W. Lazareth, and J. R. Powell 1979 5 p
refs Presented to the Am. Nucl. Soc., Atlanta, Ga. 3-8 Jun. 1979

(Contract EY-76-C-02-0016)

(BNL-NUREG-25635; Conf-790602-14)

Avail: NTIS

HC A02/MF A01

Neutronics and heating analyses were performed on a fusion reactor blanket featuring synthetic fuel production. In this two temperature region blanket design, the structural shell is stainless steel. The interior of the module is a packed ball of high temperature ceramic material. The low temperature shell and the high temperature ceramic interior are separately cooled. Process steam (approximately 1500 C) is then produced in the ceramic core for the production of H₂ and H₂-based synthetic fuels by a high temperature electrolysis (HTE) process. DOE

N80-10984# Committee on Commerce, Science, and Transportation (U. S. Senate).

NASA AUTHORIZATION FOR FISCAL YEAR 1980. PART 4: INDEX

Washington GPO 1979 122 p Hearings on S. 357 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 1979

(GPO-51-336) Avail: Comm. on Commerce, Sci., and Transportation

Indexes to appropriations for space research and development, construction of facilities, and research and program management. A.W.H.

N80-10985# Unified Industries, Inc., Alexandria, Va.

MANAGERIAL PLAN: EXECUTIVE ORDER 12003 AND THE NATIONAL ENERGY ACT

Dec. 1978 96 p

(Contract EM-77-C-01-8962)

(DOE/TIC-10067) Avail: NTIS HC A05/MF A01

A management tool is provided to assist in planning and developing the Federal Energy-Conservation Program which requires that, by 1985, Executive Branch agencies that own or will own buildings reduce building energy-consumption substantially below 1975 levels. The order also requires that all agencies of the Branch conduct programs designed to reduce energy consumption in general operations of the agency. The program

master plan defines goals, objectives strategies, and milestones within a structure that describes the framework, elements, phases, and roles of the agencies. Data requirements for the planning, implementing, evaluating, and reporting functional requirements of the executive order are included with an analysis of the DOE organizational management and resource requirements. DOE

N80-10970# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION, 1978 STUDY. 1: OVERVIEW AND FINDINGS

C. J. Berhrim, C. J. Anderson, H. Bomelburg (Battelle Pacific Northwest Labs.), M. Farahat (Argonne National Lab.), H. C. Forsberg, C. L. Hudson (Interplan Corp.), B. C. Kullman (Cambridge Systematics, Inc., Mass.), L. G. O'Connell, G. Strickland (Brookhaven National Lab.), and W. J. Walsh 15 Dec. 1978 57 p refs

(Contract W-7405-eng-48)

(UCRL-52553-Vol-1) Avail: NTIS HC A04/MF A01

Technical and cost analyses were made of electrochemical, mechanical, chemical, and thermal storage devices and power systems which are likely to provide credible alternatives to current and future internal combustion engine propulsion systems between now and the year 2000. These devices were used in conceptual designs of various energy storage propulsion systems. Their resultant performances and costs were calculated and compared against each other and against a baseline ICE vehicle system conceptually designed to provide the same performance. Aspects of concern were the effect on all-battery electric systems of optimizing batteries for the specific peak power and specific energy relationship, the effect on the relative results of using highly optimistic (10% confidence level) component characteristics; the national energy impact of the future introduction of energy storage automobiles; and the effect on prior results and conclusions of R and D achievements in the past year. DOE

N80-10975# National Bureau of Standards, Washington, D. C. **DIMENSIONS/NBS, VOLUME 63, NO. 6, JUNE 1979 Monthly Report**

Jun. 1979 37 p

(PB-297836/9; NBS/DIM-63/6)

Avail: NTIS

HC A03/MF A01 CSCL 14B

Contents: Cities in Renaissance; Keeping Tabs on Toxicity; Wanted-Better Energy Ideas; NBS Publishes Updated Survey of State Solar Energy Legislation; Characterizing South Pole Aerosols with the Raman Microprobe; Conferences; Publications; News Briefs. GRA

N80-11053*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MULTIROLE CARGO AIRCRAFT OPTIONS AND CONFIGURATIONS

D. William Conner and John C. Vaughan, III (USAF) Oct. 1979 15 p refs Presented at 1979 SAE Aerospace Meeting, 3-9 Dec. 1979

(NASA-TM-80177) Avail: NTIS HC A02/MF A01 CSCL 01C

A future requirements and advanced market evaluation study indicates derivatives of current wide-body aircraft, using 1980 advanced technology, would be economically attractive through 2008, but new dedicated freighters incorporating 1990 technology, would offer little or no economic incentive. They would be economically attractive for all payload sizes, however, if RD and T costs could be shared in a joint civil/military arrangement. For the 1994-2008 cargo market, option studies indicate Mach 0.7 propfans would be economically attractive in trip cost, aircraft price and airline ROI. Spanloaders would have an even lower price and higher ROI but would have a relatively high trip cost because of aerodynamic inefficiencies. Dedicated freighters using propfans at Mach 0.8 cruise, laminar flow control, or cryofuels, would not provide any great economic benefits. Air cushion landing gear configurations are identified as an option for avoiding runway constraints on airport requirements and/or operational constraints are noted. Author

N80-11066# National Aerospace Lab., Tokyo (Japan). V/STOL Div.

FUEL MINIMAL TAKE-OFF PATH OF JET LIFT VTOL AIRCRAFT, LOG NO. C3558

Hiroshi Nishimura 7 Aug. 1979 40 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on Feb. 1980

Avail: NTIS HC A03/MF A01

The fuel minimal take-off path analysis for jet lift type VTOL aircraft is presented. The study is made of two basic configurations, namely, separate type and swivel type. The fuel minimal take-off path problems of the two configurations are analyzed as nonlinear systems with the controls constrained by their magnitude. The solutions for both types are generally composed of two or three discontinuous segments connected by switching points. For the separate type, the singular part is analytically deterministic and unique, and plays a decisive role; but for the swivel type, the singular part is not unique. Two methods of solution involving different handling of singular parts are considered. Author

N80-11121*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. Interim Report

9 Jul. 1979 265 p

(Contract NAS9-15636)

(NASA-CR-160377; D180-25381-1)

Avail: NTIS

HC A12/MF A01 CSCL 22B

A program plan for the Solar Power Satellite Program is presented. The plan includes research, development, and evaluation phase, engineering and development and cost verification phase, prototype construction, and commercialization. Cost estimates and task requirements are given for the following technology areas: (1) solar arrays; (2) thermal engines and thermal systems; (3) power transmission (to earth); (4) large space structures; (5) materials technology; (6) system control; (7) space construction; (8) space transportation; (9) power distribution, and space environment effects. J.M.S.

N80-11122*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, PHASE 2. PART 1: MIDTERM BRIEFING

27 Jun. 1979 543 p

(Contract NAS9-15636)

(NASA-CR-160378; D180-25402-1) Avail: NTIS HC A22/MF A01 CSCL 22B

An overview of the program plan for the Solar Power Satellite Program is given. Progress in the microwave power transmission system is reported. A description is given of the following: (1) launch and recovery site facilities, systems and operations; (2) cargo packaging; (3) earth-to-LEO cargo transportation operations; (4) LEO-to-GEO cargo transportation operations; (5) personnel transportation operations; (6) space vehicles in-space maintenance operations; and (7) SPS maintenance systems and operations. Other topics discussed include GEO base operations, satellite construction operations, intra-base logistics, and GEO base definition. A research and program plan is presented along with cost estimates. J.M.S.

N80-11168# Oak Ridge National Lab., Tenn.

CHEMICAL STRUCTURES AND REACTIVITIES OF COAL AS AN ORGANIC NATURAL PRODUCT

Claire J. Collins, H. P. Hombach, B. M. Benjamin, W. H. Roark, B. Maxwell, and V. F. Raaen 1979 6 p refs Presented at 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790415-25) Avail: NTIS HC A02/MF A01

Some chemical reactions involved in coal liquefaction were studied using carbon 14 labelled compounds and nuclear magnetic resonance. It is concluded that the role of tetralin during coal conversion is (1) to act as a dispersion vehicle; (2) to supply hydrogen radicals, when needed, to trap coal radicals; and (3) in a very minor way to undergo intermolecular reaction with the coal through making and breaking of C-C (and possibly other) bonds. As a result of other experiments it is concluded that to the methods previously employed for breaking bonds in

coal molecules and thereby lowering their molecular weights, must now be added the use of solvated-electrons for breaking -CH₂-CH₂-linkages. A possible mechanism for the cleavage of bibenzyl (used as a model compound for coal) is given. DOE

N80-11179# IEA Coal Research, London (England).

COMBUSTION OF LOW GRADE COAL

G. F. Morrison Jun. 1978 90 p refs

(ICTIS/TR-02; ISBN-92-9029-016-1)

Avail: NTIS

HC A05/MF A01

A technical review of the literature is presented in order to assess the increasing extent to which lignite, brown coal, peat, and bituminous shale are combusted for power generation. Although the most common form of combustion in use today, the firing of pulverized low grade coal has presented major operational problems of erosion, corrosion, and fouling of heat exchange equipment. Recent developments in the design of pulverized-coal fired stations are discussed. Fluidized bed combustion has the potential to overcome many of these problems and a brief history of the development of this form of combustion and an assessment of current research is included. One important parameter in the future development of low grade coal combustion is the ability of power stations to comply with national emission standards. The influence of combustion mode on the emission of SO₂, NO, and particulates is reviewed. Author (ESA)

N80-11180# IEA Coal Research, London (England).

TRACE ELEMENTS FROM COAL COMBUSTION: ATMOSPHERIC EMISSIONS

M. Y. Lim May 1979 58 p refs

(ICTIS/TR-05; ISBN-92-9029-024-2)

Avail: NTIS

HC A04/MF A01

The literature relating to trace elements in coal combustion is reviewed from the point of view of atmospheric pollution. Some data on trace element concentration in coal are given and comparisons are made with atmospheric emissions from other sources. Environmental effects and potential health hazards are discussed. Radioactive emissions and trace element accumulation around power plants are also reviewed and types of equipment used for particulate control in power plants are summarized. It is concluded that the importance of coal combustion as a pollutant source depends on what type of regulations are established for emission control and on how well power plants comply with these regulations. Author (ESA)

N80-11238*# Union Carbide Corp., Tonawanda, N.Y. Linde Div.

ECONOMICS OF HYDROGEN PRODUCTION AND LIQUEFACTION UPDATED TO 1980

C. R. Baker Nov. 1979 41 p refs

(Contract NAS1-14698)

(NASA-CR-159163) Avail: NTIS HC A03/MF A01 CSCL 21D

Revised costs for generating and liquefying hydrogen in mid-1980 are presented. Plant investments were treated as straight-forward escalations resulting from inflation. Operating costs, however, were derived in terms of the unit cost of coal, fuel gas and electrical energy to permit the determination of the influence of these parameters on the cost of liquid hydrogen. Inflationary influence was recognized by requiring a 15% discounted rate of return on investment for Discounted Cash Flow financing analysis, up from 12% previously. Utility financing was revised to require an 11% interest rate on debt. The scope of operation of the hydrogen plant was revised from previous studies to include only the hydrogen generation and liquefaction facilities. On-site fuel gas and power generation, originally a part of the plant complex, was eliminated. Fuel gas and power are now treated as purchased utilities. Costs for on-site generation of fuel gas however, are included. A.R.H.

N80-11245# California Univ., Livermore. Lawrence Livermore Lab.

LABORATORY COAL GASIFIER FACILITY

W. R. Aiman, C. B. Thorsness, and R. J. Cena 16 Apr. 1979 35 p refs Presented at Spring Meeting on Western States Section, and the Combustion Inst., Provo, Utah, 23 Apr. 1979 (Contract W-7405-eng-48)

(UCRL-82602; Conf-790434-3)

Avail: NTIS

HC A03/MF A01

A laboratory coal gasifier test facility consists of systems for metering gases into an experimental gasifier, condensing the tar and water out of the product gases and flaring them, sampling and analyzing the product gases, and monitoring the gasifier during an experiment. The major items of equipment include: a mass spectrometer, a process gas chromatograph, a mini-computer, and the experimental coal gasifiers--currently a 1.5 m fixed-bed gasifier and a 0.9 m bore-hole gasifier. This facility is described and the use of the facility in validating software and hardware for use in field experiments are discussed. The results of an experiment with the 1.5 m fixed-bed gasifier are described. Temperature profiles down the centerline of the reactor at various times during the experiment are discussed. Product gas compositions are discussed. DOE

N80-11246# Oak Ridge National Lab., Tenn.

ECONOMICS OF GASOLINE PRODUCTION FROM UNDERGROUND COAL GASIFICATION VIA MOBIL-M PROCESS

M. S. Edwards, W. C. Ulrich, and R. Salmon 1979 36 p refs

Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790405-12) Avail: NTIS HC A03/MF A01

A conceptual process design and cost estimate is presented for a facility producing approximately 15,000 barrels per day of M-gasoline via methanol from synthesis gas generated by gasification of coal in situ. The design was based on experimental data obtained at the Laramie Energy Technology Center on the linked vertical well in situ coal gasification process. In-place coal consumption is 756 Mg/h (20,000 tons/day), based on a subbituminous Wyoming coal. The capital investment was estimated to be \$535 million in first quarter 1978 dollars. The product price of M-gasoline (including mixed butane LPG) is about \$240/cubed m (\$0.90/gal) at the plant gate. Calculated overall thermal efficiency for the facility was 22%, based on in-place coal. DOE

N80-11248# Metal Properties Council, Inc., New York.

PROGRAM TO DISCOVER MATERIALS SUITABLE FOR SERVICE UNDER HOSTILE CONDITIONS OBTAINING IN EQUIPMENT FOR THE GASIFICATION OF COAL AND OTHER SOLID FUELS Quarterly Progress Report, 1 Apr. 1978 - 30 Jun. 1978

A. O. Schaefer, ed. DOE 16 Oct. 1978 238 p refs

(Contract EX-76-C-01-1784)

(FE-1784-42) Avail: NTIS HC A11/MF A01

Progress is reported in screening materials for use in such plants with corrosive environments and in providing useful corrosion data as well as reliable information on other properties needed for the design, construction, and operation of such plants. The program involves high temperature corrosion studies involving low concentration of H₂S, exposure of metal coupons and refractories in coal gasification pilot plants, aqueous corrosion erosion and corrosion testing, and measurements of the mechanical and physical properties of materials. DOE

N80-11249# Institute of Gas Technology, Chicago, Ill.

RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Apr. - 30 Jun. 1978

D. A. Duncan, J. L. Beeson, and R. D. Oberle Sep. 1978 25 p refs

(Contract EX-76-C-01-2307)

(FE-2307-38; QR-1) Avail: NTIS HC A02/MF A01

Runs were made in the bench-scale unit to investigate hydrocarbon yields from North Dakota lignite at operating pressures of 500 and 1000 psig. The base carbon conversions were reduced to approximately 26 and 33%, and hydrocarbon liquids yields were reduced to 6.4 and 9.2 grams per 100 grams of feed carbon, respectively. These values are considerably lower than those obtained from North Dakota lignite in bench-scale

unit operations at 2000 psig. At that pressure, base carbon conversions were approximately 50%, and hydrocarbon liquids yields were 18 grams per 100 grams of feed carbon. Runs were also made with Illinois No. 6 bituminous coal [free-swelling-index (FSI)=4-1/2]. To avoid plugging the reactor, the coal was mixed with fine silica sand at levels of 10%, 20%, and 30% (by weight) coal with sand. The bench-scale unit was operated using an upsweeping temperature profile at coil outlet temperatures of 1450 and 1500 F and a system outlet pressure of 2000 psig. Runs with the 10% and 20% (by weight) coal were successful.

DOE

N80-11250# Electric Power Research Inst., Palo Alto, Calif. BIOFUELS: A SURVEY

John R. Benemann Jun. 1978 96 p refs Sponsored by EPRI

(EPRI-ER-746-SR) Avail: NTIS HC A05/MF A01

Photosynthesis, plant productivity, waste and residue resources, 'energy farming,' processes for using biomass directly or converting it to fuels, and overall economics are discussed. Applications by U.S. industries and utilities are emphasized and current U.S. research and development programs presented. With foreseeable technologies and economics, approximately 5% of the fossil fuels now consumed in the United States could presently be replaced by available forestry, agricultural, and municipal wastes and residues.

DOE

N80-11251# Department of Energy, Washington, D. C. Energy Policy Office.

NATIONAL GAS SURVEY REPORT TO THE FEDERAL ENERGY REGULATORY COMMISSION BY THE SUPPLY-TECHNICAL ADVISORY TASK FORCE ON NONCONVENTIONAL NATURAL GAS RESOURCES

Jun. 1978 116 p refs

(DOE/FERC-0010) Avail: NTIS HC A06/MF A01

An analysis of the future energy situation in the U.S. with emphasis on the natural gas industry is presented. The analysis includes chapters on historical research efforts, industry criteria for commercialization of coal bed gas, technology for recovering methane from coal beds, identification of problems, legal concerns, and environmental considerations.

DOE

N80-11254# New York City Resource Recovery Task Force, N. Y.

METHANE RECOVERY FROM SANITARY LANDFILLS; GAS RECOVERY SYSTEM INSTALLATION AND TESTING Interim Report

Dec. 1978 45 p refs Prepared in cooperation with Brooklyn Union Gas Co., N. Y. and Wegman Co., Inc., Buffalo, N. Y.

(PB-296622/4; NYSEDA-78/18) Avail: NTIS HC A03/MF A01 CSCL 21D

A methane gas recovery program to mine this clean energy form from the municipal solid wastes deposited at the New York Fresh Kills Landfill in Staten Island, New York is described. Optics covered include the results of a six-week test program subsequent modifications made to the gas system, and the objectives and plans for the phase 3 landfill gas utilization program.

GRA

N80-11255# Mitre Corp., McLean, Va. Metrek Div. ASSESSMENT OF LONG TERM RESEARCH NEEDS FOR COAL-GASIFICATION TECHNOLOGIES Final Report

Apr. 1979 201 p

(Contract ER-78-C-01063)

(PB-297853/4; MTR-79W00160) Avail: NTIS HC A10/MF A01 CSCL 07A

An assessment of research areas that affect long term development of coal gasification technologies is presented. Research recommendations and findings are discussed. Included are: an analysis of the major application areas for coal gasification technologies; discussion of the status and needs of the principal systems according to reactor type (fixed bed, fluidized bed, etc.); reports from site visits and communications with technology developers; and in-depth assessment of basic research needs in the critical areas of scaling and modeling, materials, effluent

characterization, diagnosis and instrumentation, coal chemistry, catalytic chemistry, gas particle systems, and unit operations.

GRA

N80-11259# Army Construction Engineering Research Lab., Champaign, Ill.

THE BUILDING LOADS ANALYSIS SYSTEM THERMODYNAMICS (BLAST) PROGRAM, VERSION 2.0. INPUT BOOKLET Final Report

E. Sowell Jun. 1979 118 p

(AD-A072435; CERL-TR-E-153)

Avail: NTIS

HC A06/MF A01 CSCL 09/2

The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle costs.

GRA

N80-11348# Los Alamos Scientific Lab., N. Mex.

SOME dc SUPERCONDUCTING CABLES

William E. Keller 1979 27 p refs Presented at the 1979 Workshop on Public Policy Aspects of High Capacity Electric Power Transmissions, Aspen, Colo., 14-16 May 1979

(Contract W-7405-eng-26)

(LA-UR-79-1057; Conf-790527-1)

Avail: NTIS

HC A03/MF A01

The general characteristics of dc superconducting cables as well as details of two specific designs, one coaxial and the other double monopolar, are discussed. The special advantages of these cables lie in the relative simplicity of construction, their extremely high operating efficiency, and their compactness when compared with other ac or dc high-capacity cables cooled by flowing fluids, either at ambient or cryogenic temperatures. These features are discussed in the context of economic, environmental, and power system considerations, including some of the possible trade-offs among conventional and superconducting ac and dc systems.

DOE

N80-11368# AEG-Telefunken, Berlin (West Germany). Forschunginst.

UNCONVENTIONAL CIRCUITS FOR STATIC VOLTAGE TRANSFORMERS Final Report

Johannes Nestler, Guenther Junge, Ingeborg Tzivelekas, and Hans Wrede Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 269 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-78-26) Avail: NTIS HC A12/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 56.90

The design and development of circuits for static converters are reported on. These include primarily thyristor/transistor circuits as well as a circuit for load-controlled converters. In thyristor/transistor circuits transistors are used for quenching and commutation purposes as well as to protect thyristors. With these circuits the rated current can be commuted down to very low input voltages. The load-controlled converter by virtue of this method of commutation is characterized by simple design and by the fact that it displays high efficiency at high clock frequencies. Two load-controlled converters were constructed, one of which provided a power of 20 kW at a clock frequency of 7 kHz, the efficiency achieved being 90%. Modular systems were developed for voltage converters. In this connection the possible application of heat pipes was examined for such converters with respect to the dependence on mounting position and the start-up and peak load behavior.

Author (ESA)

N80-11384# Bendix Corp., Kansas City, Mo.
COOLING ALUMINUM MOLDS USING HEAT PIPES Final Report

D. R. Hahn Dec. 1978 49 p ref Revised
 (Contract EY-76-C-04-0613)
 (BDX-613-2039-Rev) Avail: NTIS HC A03/MF A01

A system was developed to provide zone cooling and more efficient heat removal from an aluminum mold used to make a polyurethane foam part. Heat removal with heat pipes and forced convection was four to six times faster than cooling without heat pipes in still air. Tests are planned to determine if zone cooling will reduce shrinkage depressions in parts fabricated in this mold. DOE

N80-11386# California Univ., Livermore. Lawrence Livermore Lab.

TWO-DIMENSIONAL TRANSIENT DISPERSION AND ADSORPTION IN POROUS MEDIA

R. V. Homsy 23 Apr. 1979 11 p refs Presented at 5th Underground Coal Conversion Symp., Alexandria, Va., 18 Jun. 1979

(Contract W-7405-eng-48)
 (UCRL-81970; Conf-790630) Avail: NTIS HC A02/MF A01

Contaminant transport model was made of an underground aquifer following in situ coal gasification to determine the environmental impact on ground water. The aquifer was treated as a semi-infinite porous medium, bounded on top and bottom by impermeable parallel walls. Line, plane and finite-volume sources were studied. The two-dimensional convective-dispersion equation, which governs the rate of contaminant transport, was reduced to an ordinary differential equation and solved for an instantaneous source. Asymptotic series solutions valid for short and long times are given for a continuous-line source. DOE

N80-11387# Idaho National Engineering Lab., Idaho Falls.
HEAT TRANSFER CORRELATION DEVELOPMENT AND ASSESSMENT: A SUMMARY AND ASSESSMENT OF RETURN TO NUCLEATE BOILING PHENOMENA DURING BLOWDOWN TESTS CONDUCTED AT THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL)

A. M. Eaton and E. L. Tolman Apr. 1979 80 p refs
 (Contract EY-76-C-07-1570)
 (CDAP-TR-054) Avail: NTIS HC A05/MF A01

The data are presented which were obtained in Loss-of-Coolant Experiments (LOCE) which demonstrate the presence of cladding rewetting after the critical heat flux has been exceeded as a viable cooling mechanism during the blowdown phase of a LOCE. A brief review of the mechanisms associated with the boiling crisis and rewetting is also provided. The relevance of LOCE rewetting data to nuclear reactor licensing Evaluation Model Requirements is considered, and the conclusion is made that the elimination of rewetting and return to nucleate boiling in evaluation models represents a definite conservatism. DOE

N80-11532*# Battelle Columbus Labs., Ohio.
SEASAT DEMONSTRATION EXPERIMENTS WITH THE OFFSHORE OIL, GAS AND MINING INDUSTRIES Final Report

A. G. Mourad, A. C. Robinson, and J. E. Balon Nov. 1979 145 p refs
 (Contract NASw-2800)
 (NASA-CR-162423; BCL-OA-TFR-79-6) Avail: NTIS HC A07/MF A01 CSCL 05B

Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world's oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatorial East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas.A.R.H.

N80-11543# Los Alamos Scientific Lab., N. Mex.
GEOTHERMAL EXPLORATION METHODS AND RESULTS: INLAND STATES

J. C. Maxwell 1979 3 p refs Presented at Symp. on Geothermal Energy and its Direct Uses in the Eastern United States, Hot Springs, Va., 5 Apr. 1979
 (Contract W-7405-eng-36)
 (LA-UR-79-665; Conf-790433-2) Avail: NTIS HC A02/MF A01

The Los Alamos Scientific Laboratory geothermal exploration sequence includes: (1) review of AAPG/USGS gradient maps; (2) literature search; (3) consideration of potential markets; (4) groundwater silica geothermometry; (5) analysis of bottom-hole temperatures; (6) heat flow measurement of available wells; and (7) drilling of new tests holes. Anomalies were located near Syracuse, NY (36 C/km, 56 C silica max.), near Buffalo, NY (36 C/km, 65 C silica max.), southeast Ohio, western and southwestern Nebraska, and three new warm springs in Arkansas. Other investigations found high heat generation (14 to 25 HGU) in the White Mountain batholith NH (170 C calculated at 6 km depth), uparching of the Adirondac Dome, NY, and potentially economic electricity from hot brines in southwest Arkansas.DOE

N80-11544# Texas Univ., Austin.
TERTIARY OIL RECOVERY PROCESSES RESEARCH AT THE UNIVERSITY OF TEXAS Annual Report, Oct. 1977 - Sep. 1978

R. S. Schechter and W. H. Wade Washington DOE Dec. 1978 61 p refs
 (Contract EW-78-S-19-0001)
 (BETC-0001-1) Avail: NTIS HC A04/MF A01

Many species of monoisomeric alkyl-substituted benzene sulfonates were synthesized and examined at low concentrations. Interfacial tension in particular was studied. Optimum salinity for high surfactant concentrations was defined as the middle of the 3-phase region. Work on surfactant adsorption was focused on a model that can explain maxima and minima in adsorption curves. A model for diffusion and stranding at the aqueous surfactant-oil interface was applied to spontaneous emulsification and extended to systems that form middle-phase microemulsions. DOE

N80-11545# Pennzoil Co., Vienna, W. Va.
OIL RECOVERY BY CARBON DIOXIDE INJECTION Annual Report, Jul. 1977 - Jul. 1978

L. G. Guckert and G. P. SanFilippo DOE Sep. 1978 57 p
 (Contract EF-76-C-05-5301)
 (ORO-5301-34) Avail: NTIS HC A04/MF A01

A project to determine the feasibility of miscible carbon dioxide oil recovery in the Rock Creek Big Injun field in Roane County, West Virginia is now showing a response to waterflood. Water injection into the backup injection wells was initiated on October 16, 1976 and water injection into the six pattern injection wells commenced on April 22, 1977. As of July 1, 1978, the cumulative injection into the nineteen injection wells totaled 1,306,966 barrels. DOE

N80-11546# Gary Operating Co., Englewood, Colo.
BELL CREEK RESIDUAL OIL SATURATION TECHNOLOGY TEST Quarterly Report, Oct. 1978 - Dec. 1978

D. Myal 18 Jan. 1979 7 p
 (Contract ET-78-C-03-2180)
 (BETC-2180-4) Avail: NTIS HC A02/MF A01

The capabilities of different techniques to measure residual oil saturation, in situ, in a consolidated sandstone reservoir were assessed to provide a basis for selecting appropriate methods for determining oil saturation at tertiary recovery pilot test sites. DOE

N80-11551# West Virginia Univ., Morgantown. Thermal-Hydraulics Lab.

EFFECT OF VERTICAL SCALE DISTORTION ON THE TEMPERATURE FIELD OF A THERMAL-HYDRAULIC MODEL

D. P. Michelotti, R. A. Bajura, and S. H. Swartz Nov. 1978 131 p refs
(Contract DI-14-34-0001-6214; OWRT Proj. C-7171(6214)(4))
(PB-297274/3; DPM-RAB/SHS-78-1; RR-9) Avail: NTIS
HC A07/MF A01 CSCL 13B

The generation of electricity by pumped storage hydroelectric plants to supplement existing thermal power plant facilities for peak energy supply is discussed and the effects of a vertical scale distortion on the flow and temperature fields of a hydraulic model of a pumped storage reservoir system are assessed. Vertical to horizontal scale ratios of 1:1, 3:1, and 5:1 were considered. The model consisted of a submerged hot water jet discharging into an initially cold isothermal reservoir. The jet discharge geometry was patterned after what was considered to be a typical pumped storage outlet. Results are presented for various jet Froude numbers. GRA

N80-11554 International Institute for Applied Systems Analysis, Laxenburg (Austria).

MEDEE 2: A MODEL FOR LONG TERM ENERGY DEMAND EVALUATION

Bruno Lapillonne Nov. 1978 53 p refs
(IIASA-RR-78-17) Avail: Issuing Activity

A simulation model, MEDEE 2, designed to evaluate the long-term energy demand of a country in combination with a scenario description of the main aspects of the country's social, economic, and technological evolution is described. Parameters taken into consideration are end-use total demand by category (e.g., residential space heating, service sector cooling, gasoline for intercity cars) and the potential market (maximum demand that can be technically met) for each final energy form (electricity, coal, gas, solar, oil products, and district heat). The model also calculates useful energy demand in each end-use category for which several energy forms can be used, thus determining the substitution possibilities in energy use. The scenario description is complemented with technological parameters (e.g., insulation standards, efficiencies, fuel mix), the evolution of which is specified in a way consistent with the macroeconomic assumptions.

Author (ESA)

N80-11556# Committee on Interstate and Foreign Commerce (U. S. House).

SOLAR COMMERCIALIZATION

Washington GPO 1979 548 p refs Hearings before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 96th Congr., 1st Sess., 10-11 Jan. 1979

(GPO-43-586) Avail: Subcomm. on Energy and Power

Government policies to commercialize solar energy and a program to encourage solar energy commercialization are examined. Solar energy technology and the applications of this technology are discussed. The role of government in solar energy commercialization is debated. A.W.H.

N80-11557# Committee on Energy and Natural Resources (U.S. Senate).

ENERGY INITIATIVES OF THE 95TH CONGRESS

Washington GPO 1979 342 p refs Rept. for Comm. on Energy and Natural Resources, 96th Congr., 1st Sess., May 1979

(GPO-42-797; Publ-96-10) Avail: SOD HC

Congressional response to the energy problem is defined and assessed. Actions toward the utilization of solar energy, nuclear energy, geothermal energy, and the production of alcohol fuels, natural gas, and crude oils is reported. A.W.H.

N80-11558# General Electric Co., Philadelphia, Pa. Space Div.

EXECUTIVE SUMMARY: MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT Final Report

Mar. 1979 61 p

(Contracts NAS3-20058; EC-77-A-29-1010)

(NASA-CR-159497; DOE/NASA/0058-79/3) Avail: NTIS
HC A04/MF A01 CSCL 10A

Activities leading to the detail design of a wind turbine generator having a nominal rating of 1.8 megawatts are reported. Topics covered include (1) system description; (2) structural dynamics; (3) stability analysis; (4) mechanical subassemblies design; (5) power generation subsystem; and (6) control and instrumentation subsystem. A.R.H.

N80-11559# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

AN EVALUATION OF THE NASA TECH HOUSE, INCLUDING LIVE-IN TEST RESULTS, VOLUME 1

Ira H. A. Abbott, Kenneth A. Hopping, and Warren D. Hypes Nov. 1979 72 p refs

(NASA-TP-1564; L-13440) Avail: NTIS HC A04/MF A01 CSCL 10A

The NASA Tech House was designed and constructed at the NASA Langley Research Center, Hampton, Virginia, to demonstrate and evaluate new technology potentially applicable for conservation of energy and resources and for improvements in safety and security in a single-family residence. All technology items, including solar-energy systems and a waste-water-reuse system, were evaluated under actual living conditions for a 1 year period with a family of four living in the house in their normal lifestyle. Results are presented which show overall savings in energy and resources compared with requirements for a defined similar conventional house under the same conditions. General operational experience and performance data are also included for all the various items and systems of technology incorporated into the house design. Author

N80-11560# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT Quarterly Report, 9 Oct. 1976 - 9 Jan. 1977

Jan. 1977 198 p

(Contract NAS8-32093)

(NASA-CR-150873; F3737-QR-102)

Avail: NTIS

HC A09/MF A01 CSCL 10A

Progress in the development of prototype solar heating/cooling systems is reported. Results obtained from refinement/improvement of the single family, multifamily, and commercial systems configurations and generalized studies on several of the subsystems are presented. J.M.S.

N80-11561# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.

SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS, PHASE 1 Annual Report, 15 Jun. 1978 - 15 Jun. 1979

H. I. Yoo, P. A. Iles, and D. P. Tanner 15 Jun. 1979 174 p refs

(Contract JPL-955089)

(NASA-CR-162427; DOE/JPL-955089-79/4;

DRL-74/DRD-SE) Avail: NTIS HC A08/MF A01 CSCL 10A

Solar cells from RTR ribbons, EFG (RF and RH) ribbons, dendritic webs, Silso wafers, cast silicon by HEM, silicon on ceramic, and continuous Czochralski ingots were fabricated using a standard process typical of those used currently in the silicon solar cell industry. Back surface field (BSF) processing and other process modifications were included to give preliminary indications of possible improved performance. The parameters measured included open circuit voltage, short circuit current, curve fill factor, and conversion efficiency (all taken under AM0 illumination). Also measured for typical cells were spectral response, dark I-V characteristics, minority carrier diffusion length, and photoresponse by fine light spot scanning. The results were compared to the properties of cells made from conventional single crystalline Czochralski silicon with an emphasis on statistical evaluation. Limited efforts were made to identify growth defects which will influence solar cell performance. A.R.H.

N80-11562# Motorola, Inc., Scottsdale, Ariz.

THE AUTOMATED ARRAY ASSEMBLY TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Annual Report

M. G. Coleman, L. P. Grenon, E. M. Pastirik, R. A. Pryor, and T. G. Sparks Nov. 1978 213 p
(Contract JPL-954847; Proj. 2345)
(NASA-CR-162429; DOE/JPL-954847-78/4) Avail: NTIS
HC A10/MF A01 CSDL 10A

An advanced process sequence for manufacturing high efficiency solar cells and modules in a cost-effective manner is discussed. Emphasis is on process simplicity and minimizing consumed materials. The process sequence incorporates texture etching, plasma processes for damage removal and patterning, ion implantation, low pressure silicon nitride deposition, and plated metal. A reliable module design is presented. Specific process step developments are given. A detailed cost analysis was performed to indicate future areas of fruitful cost reduction effort. Recommendations for advanced investigations are included.

A.R.H.

N80-11564* Hughes Research Labs., Malibu, Calif.
ELECTRON RADIATION DAMAGE OF (AlGa) As-GaAs SOLAR CELLS Final Report, 25 Apr. 1978 - 24 Apr. 1979
R. Loo, G. S. Kamath, and R. Knechtli Oct. 1979 71 p refs
Prepared for JPL
(Contract NAS7-100)
(NASA-CR-162425) Avail: NTIS HC A04/MF A01 CSDL 10A

Solar cells (2 cm by 2 cm (AlGa) As-GaAs cells) were fabricated and then subjected to irradiation at normal incidence by electrons. The influence of junction depth and n-type buffer layer doping level on the cell's resistance to radiation damage was investigated. The study shows that (1) a 0.3 micrometer deep junction results in lower damage to the cells than does a 0.5 micrometer junction, and (2) lowering the n buffer layer doping density does not improve the radiation resistance of the cell. Rather, lowering the doping density decreases the solar cell's open circuit voltage. Some preliminary thermal annealing experiments in vacuum were performed on the (AlGa)As-GaAs solar cells damaged by 1-MeV electron irradiation. The results show that cell performance can be expected to partially recover at 200 C with more rapid and complete recovery occurring at higher temperature. For a 0.5hr anneal at 400 C, 90% of the initial power is recovered. The characteristics of the (AlGa)As-GaAs cells both before and after irradiation are described. R.E.S.

N80-11565* Solarex Corp., Rockville, Md.
PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SILICON SOLAR ARRAY PROJECT
Manfred Wihl, John Torro, Alan Scheinine, and Jack Anderson Nov. 1978 86 p. Sponsored by JPL and DOE
(Contract JPL-954854)
(NASA-CR-162426; DOE/JPL-954854-77/4) Avail: NTIS
HC A05/MF A01 CSDL 10A

An automated process sequence, to manufacture photovoltaic modules at a capacity of approximately 500 MW per year at a cost of approximately \$0.50 per peak watt is described. Verification tests were performed and are reported along with cost predictions. R.E.S.

N80-11567# California Univ., Berkeley. Lawrence Berkeley Lab.

ON-LINE TESTS OF ORGANIC ADDITIVES FOR THE INHIBITION OF THE PRECIPITATION OF SILICA FROM HYPERSALINE GEOTHERMAL BRINE. 2: TESTS OF NITROGEN-CONTAINING COMPOUNDS, SILANES, AND ADDITIONAL ETHOXYLATED COMPOUNDS

J. E. Harrar, F. E. Locke, C. H. Otto, Jr., L. E. Lorensen, and W. P. Frey 1 Jun. 1979 24 p refs
(Contract W-7405-eng-48)
(UCID-18195) Avail: NTIS HC A02/MF A01

Several new classes of organic compounds were screened as potential geothermal scale control agents by examining their effect on the precipitation of silica from Magmamax No. 1 brine. The substances were tested using the Brine Treatment Test System at the Niland, California, Test Site. Solutions of the test substances were injected into flowing brine at 210 C, the brine was flashed to 125 C, and then the kinetics of solids and silica precipitation from effluent brine held at 90 C were measured. Three new types of compounds were shown to have activity as precipitation

inhibitors: polyethylene imines, polyethyloxazalines, and quaternary ammonium compounds containing polyoxyethylene. Among the latter, Ethoquad 18/24, which is methylpolyoxyethylene(15) octadecylammonium chloride, is the leading candidate antiscalant. It is a more powerful inhibitor of silica precipitation than the pure polyoxyethylene polymers, and it apparently has no high temperature solubility limitations. Measurements were made of the concentrations of monomeric silica and the effect of addition of inhibitor at various points in the Brine Treatment Test System. DOE

N80-11570* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAMICS: INPUT DATA PREPARATION
R. G. Chamberlain and R. W. Aster 1 Mar. 1979 35 p ref
Revised
(NASA-CR-162421; DOE/JPL-1012-22-Rev-A) Avail: NTIS
HC A03/MF A01 CSDL 10A

The Solar Array Manufacturing Industry Costing Standards (SAMICS) provide standard formats, data, assumptions, and procedures for estimating the price that a manufacturer would have to charge for the product of a specified manufacturing process sequence. A line-by-line explanation is given of those standard formats which describe the economically important characteristics of the manufacturing processes and the technological structure of the companies and the industry. This revision provides an updated presentation of Format A Process Description, consistent with the October 1978 version of that form. A checklist of items which should be entered on Format A as direct expenses is included. DOE

N80-11571# Rocket Research Corp., Redmond, Wash.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Interim Report
Feb. 1979 105 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-27) Avail: NTIS HC A06/MF A01

Heat pump centered integrated community energy systems (HP-ICES) are energy systems for communities which provide heating, cooling, and/or other energy services through the use of heat pumps. Since heat pumps primarily transfer energy from existing and otherwise probably unused sources, rather than convert it from electrical or chemical to thermal form, HP-ICES are viewed as having significant potential for energy conservation. The System Development phase of the HP-ICES project is described and the results are reported. DOE

N80-11573# Mechanical Technology, Inc., Latham, N. Y.
HIGH COP HEAT PUMP SYSTEM, PHASE 1, RESULTS
Apr. 1979 151 p
(Contract EC-77-C-01-5056)
(HCP/M5056-01; TR-1) Avail: NTIS HC A08/MF A01

The High COP Heat Pump System described is a device for recovering heat or energy usually lost in process streams by rejection to once-through cooling systems. The acetone recovers process makes use of river water to cool process streams, with the river water taking on heat in the heat exchange process. Heat or energy is thereby rejected from the process stream and is not recovered for reuse. The MTI Heat Pump System allows reuse of this energy. The estimated cost of a production Heat Pump System is \$625,000 plus installation. The system can deliver 20 million BTU's per hour of latent steam energy. Based on a steam cost of \$1.89 million BTU's for natural gas, the system being in service for 7884 hours per year (90% in-service rate), a 20% investment tax credit and installation costs at 50% of hardware costs; the discounted cash flow rate of return is 29.5%. Breakeven points are 2.6, 3.6, and 4 years for oil, gas and coal respectively. Details are provided about the Heat Pump System operation in the section entitled Process Description. Cycle Optimization is discussed, providing insight on the technique of determining the optimum system configuration. System Sensitivity shows how relatively little the output varies with changes in turbine and compressor efficiencies. Details of System Design are given, in which design objectives, applicable codes, working fluid, general arrangement, and component design features are discussed. Installation at the host site is analyzed.

as is System Cost. Under Environmental Effects, it is shown that the Heat Pump System will increase the quality of the environment. DOE

N80-11674# Georgia Inst. of Tech., Atlanta.
HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS; SYSTEM DEVELOPMENT Interim Report

D. W. Wade, B. C. Trammel, B. S. Dixit, D. C. McCurry (McCurry and Assoc., Atlanta), and B. A. Rindt (McCurry and Assoc., Atlanta) Feb. 1979 201 p refs Prepared for Argonne National Lab. (Contract W-31-109-eng-38)
 (ANL-ICES-TM-28) Avail: NTIS HC A10/MF A01

The heat pump - wastewater heat recovery (HP-WHR) scheme is one approach to heat pump centered integrated community energy systems that proposes to reclaim low grade thermal energy from a community's wastewater effluent. The concept of an HP-WHR system is developed, the potential performance and economics of such a system is evaluated and the potential for application is examined. A thermodynamic performance analysis of a hypothetical system projects an overall system coefficient of performance of from 2.181 to 2.264 for wastewater temperatures varying from 50 F to 80 F. Primary energy source savings from the implementation of this system is projected to be 5.014 QUADS, or the energy equivalent of 687 millions tons of coal, from 1980 to the year 2000. Economic analysis shows the HP-WHR scheme to be cost competitive, on the basis of a net present value life cycle cost comparison, with conventional residential and light commercial systems. DOE

N80-11576# Argonne National Lab., Ill. Energy and Environmental Systems Div.

TRANSFER OF ENERGY CONSERVATION TECHNOLOGY TO INDUSTRY. A PRELIMINARY SURVEY OF EXISTING MECHANISMS

Carolyn S. Colsher and Allan R. Evans Sep. 1978 55 p refs (Contract W-31-109-eng-38)
 (ANL/EES-TM-28) Avail: NTIS HC A04/MF A01

To ascertain the current level of interest, capabilities, and involvement in the dissemination of information on industrial energy conservation, a survey was conducted. Based upon 150 responses from major groups, it was found that although form and level of activity varied widely, the most frequently used communications channels were workshops, seminars, conferences, energy audits, energy committees, and distribution of literature. Among the areas cited as needing improvement was (1) awareness and acquisition of literature and (2) availability of industry or process specific technical manuals for plant managers or engineers. The most successful government/industry interfaces were felt to be workshops held cooperatively with trade associations, programs to encourage sharing of generic conservation techniques between firms, and published literature. DOE

N80-11577# Argonne National Lab., Ill. Energy and Environmental Systems Div.

IMPLEMENTING ENERGY CONSERVATION STRATEGIES IN ENERGY MATERIALS TRANSPORT: U. S. DEPARTMENT OF ENERGY AND OTHER GOVERNMENT AGENCY POLICY-MAKING DECISIONS

K. M. Bertram Nov. 1978 62 p refs
 (Contract W-31-109-eng-38)

(ANL/EES-TM-32) Avail: NTIS HC A04/MF A01

The policy-making channels within Federal agencies for the strategy implementation efforts of U. S. Department of Energy conservation projects are defined. Government agency policy-making mechanisms are reviewed and analyzed. Emphasis was placed upon relevant Federal agencies and summary treatment given other federal, state, and local agencies. Brief case studies were made of states and localities which have significant effects upon energy materials transport systems. The main findings of the report are that two primary channels exist for effecting this project's policy-oriented strategies: inputs to legislation and inducement of regulatory involvements. DOE

N80-11578# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
WIND ENERGY SYSTEMS: PROGRAM SUMMARY

Dec. 1978 134 p refs

(DOE/ET-0093) Avail: NTIS HC A07/MF A01

Projects to develop reliable and economically viable wind energy systems and enable the earliest possible commercialization of wind power are described. The program's general organization is also described. DOE

N80-11579# California Univ., Berkeley. Lawrence Berkeley Lab.

GEOTHERMAL ENERGY FOR INDUSTRIAL APPLICATION

R. L. Fulton Mar. 1979 19 p refs Presented at Assoc. of Energy Engineers Conf., San Francisco, Calif., 21 Mar. 1979 (Contract W-7405-eng-48)

(LBL-8919; Conf-790358-1) Avail: NTIS HC A02/MF A01

The types of geothermal resources are reviewed briefly. The uses of geothermal energy for electrical generation and non-electric direct use are described. DOE

N80-11580# Sandia Labs., Albuquerque, N. Mex.

CONCENTRATING SOLAR COLLECTOR TEST RESULTS COLLECTOR MODULE TEST FACILITY (CMTF) Summary Report, Jan. - Dec. 1978

V. E. Dudley and R. M. Workhoven Mar. 1979 54 p refs (Contract EY-76-C-04-0789)

(SAND-78-0977) Avail: NTIS HC A04/MF A01

The results are summarized of tests on four concentrating solar collectors at output fluid temperatures from 100 C to 300 C. DOE

N80-11581# Sandia Labs., Albuquerque, N. Mex.

HEAT LOSS REDUCTION TECHNIQUES FOR ANNULAR SOLAR RECEIVER DESIGNS

A. C. Ratzel and C. E. Simpson Feb. 1979 56 p refs (Contract EY-76-C-04-0789)

(SAND-78-1769) Avail: NTIS HC A04/MF A01

Analytical and experimental work was undertaken to quantify thermal conduction and natural convection heat losses in annular solar receiver geometries. Techniques studied for reducing conduction heat loss include evacuation of the annulus gas, oversizing of the annular space while maintaining slight vacuum levels, and use of gases other than air in the annular space. DOE

N80-11582# Sandia Labs., Albuquerque, N. Mex.

DESIGN CONSIDERATIONS FOR A PROPOSED PASSIVE VACUUM SOLAR ANNULAR RECEIVER

T. D. Harrison, G. N. Bond, and A. C. Ratzel Apr. 1979 43 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0982) Avail: NTIS HC A03/MF A01

Testing of an east-west 90 deg parabolic trough collector revealed problems associated with achieving and maintaining annulus pressures below 1 Pa along with other receiver problems and maintaining annulus pressures below 1 Pa along with other receiver problems (black chrome degradation) that reduced the performance of the collector. Analyses of the test results show that a vacuum in the annulus of the receiver assembly can significantly increase the amount of energy collected daily by at least 13% depending upon the reflector trough and tracking capabilities of the collector design. The problem associated with the current receiver are described and a modified passive vacuum design intended to correct the problems is presented. Test results will determine whether the value of the additional energy collected is greater than the cost of achieving the vacuum. DOE

N80-11585# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

REGIONAL REFERENCE ENERGY SYSTEMS: ELECTRIC UTILITY APPLICATIONS

A. Hermelee Jan. 1979 106 p refs

(Contract EY-76-C-02-0016)

(BNL-50962) Avail: NTIS HC A06/MF A01

The Reference Energy Systems (RES) projection methodology is reformulated in order to apply the format to an electric utility region. The system's approach, incorporating all resources,

technologies and uses of energy, allows a utility to assess the impact of alternate technologies and policies across the entire energy system. Demand patterns for 25 end-use demand categories within the residential, commercial, industrial, and transportation sectors are developed for a base case scenario representing reasonable energy use patterns derived in a consistent manner by applying engineering techniques to the best available information. The impact of a new technology in terms of resource consumption is evaluated by modifying the energy flow paths to incorporate the new technology. Alternate paths through the network reflect the substitutability of resources and technologies for one another. DOE

N80-11586# Argonne National Lab., Ill.

DOE HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS PROJECT

J. M. Calm 1979 17 p refs Presented at Heat Pump Technol., Inform. Exchange Meeting, Gaithersburg, Md., 7 Mar. 1979 (Contract W-31-109-eng-38)

(CONF-790362-1) Avail: NTIS HC A02/MF A01

The development of centralized, distributed, and cascaded heat pump centered integrated community energy systems using both waste and natural heat is discussed. These systems show promise for cost reduction, increased reliability, and avoidance of adverse environmental effects in providing process and space heating and cooling. K.L.

N80-11587# Argonne National Lab., Ill.

WORLD ENERGY DATA SYSTEM (WENDS)

W. E. Lareau 1979 45 p refs Presented at the Spring Meeting of the Assoc. of System 2000 Users for Tech. Exchange (ASTUTE), Austin, Tex., 3 Apr. 1979 (Contract W-31-109-eng-38)

(CONF-790461-2) Avail: NTIS HC A03/MF A01

The storage of preformatted textual information in a completely user oriented data base, the World Energy Data System, is discussed. The system allows qualified users online access to nonclassified management level data on worldwide energy technology and research and development activities. WENDS transmits up-to-date information on foreign energy technology and research and development programs to DOE program divisions, the Congress, and other U.S. Government officials going abroad. The WENDS concept is described and the method storing and retrieving the textual information is discussed. DOE

N80-11589# Department of Energy, Seattle, Wash.

INCREASED ENERGY FROM BIOMASS: 1985 POSSIBILITIES AND PROBLEM. WORKING PAPERS FOR PLANNERS

1978 202 p From Pacific Northwest Bioconversion Workshop, Portland, Oreg., 24-26 Oct. 1978; Sponsored in cooperation with the Energy Offices of Alaska, Idaho, Montana, Oregon and Washington, U. S. Forest Service and Oregon State Univ. (RLO-788-5; Conf-7810132) Avail: NTIS HC A10/MF A01

Summaries, together with charts and data in some cases, of the talks given by panelists to the Conference are compiled. The first four sessions examined current agricultural and peat applications with emphasis on wood use. The resource base for agricultural wastes, peat, and wood was evaluated. In the fifth session the barriers and constraints on the use of biomass as an energy source were identified and some possible solutions suggested. The sixth session consisted of work groups on the production of gaseous and liquid fuels, utility applications of biomass and impacts, residential and small scale applications, and biomass supply systems. Extensive summaries were provided of the discussions of each work group; these included recommendations on private and public actions necessary to foster the use of biomass for energy. DOE

N80-11590# Department of Energy, Washington, D. C.

DEPARTMENT OF ENERGY FOSSIL ENERGY EQUIPMENT DEVELOPMENT PROGRAMS

J. L. Powell, W. R. Williams (ORNL), T. K. Lau, and H. T. Jones Apr. 1979 13 p refs Presented at AICE Meeting, Houston, Tex., 1 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790405-14) Avail: NTIS HC A02/MF A01

Design, construction, and operation of synthetic fuel processing plants in the near future must consider equipment requirements to make such operations economically feasible and sound. The Department of Energy's approach is to use as much available equipment as practical, to modify and qualify equipment which is not expected to perform acceptably in its standard configuration, and to develop new equipment only if no current capability or acceptable alternative exists. Approaches, philosophy, goals, and implementation of fossil energy equipment development programs are discussed. Some results of a recent survey of industrial coal conversion equipment capabilities are presented as an example of current equipment, state-of-the-art and equipment development needs. DOE

N80-11592# Los Alamos Scientific Lab., N. Mex.

DEVELOPMENT OF INTEGRATED THERMIONIC CIRCUITS FOR GEOTHERMAL HIGH-TEMPERATURE APPLICATIONS

J. Byron McCormick and D. Wilde 1979 6 p refs Presented at 20th Ann. Logging Symp., Tulsa, Okla., 3 Jun. 1979 (Contract W-7405-eng-36)

(LA-UR-79-723; Conf-790605-1)

(LA-UR-79-723; Conf-790605-1)

Avail: NTIS HC A02/MF A01

A new integrated thermionic device capable of withstanding ambient temperatures in excess of 500 C is reported. The evolution of the integrated thermionic circuit (ITC) is discussed and a set of practical device design and performance equations are demonstrated. DOE

N80-11593# Department of Energy, Washington, D. C. Economic Regulatory Administration.

STANDBY CONSERVATION PLAN NO. 2: EMERGENCY BUILDING TEMPERATURE RESTRICTIONS. ECONOMIC ANALYSIS

Feb. 1979 39 p refs

(DOE/ERA-0047) Avail: NTIS HC A03/MF A01

The emergency building temperature restrictions plan is intended to be implemented in the event of a petroleum supply interruption or to satisfy the obligations of the United States under the International Energy Program. The economic impact of the measure was analyzed by assuming that the measure was implemented during 1980-1981 in a hypothetical petroleum shortfall of 15%. The plan is designed to reduce energy consumption by placing restrictions on thermostat settings for heating, cooling, and hot water in commercial, industrial, and public buildings. Specifically, the plan would mandate a maximum thermostat setting of 65 F for space heating, a minimum setting of 80 F for space cooling, and maximum setting of 105 F for hot water. Hotels and motels, hospitals, and areas of buildings where specific temperatures are required to maintain special equipment or supplies are exempt. Also exempt is hot water used for dishwashing and other uses where health codes require higher temperatures for sanitation. Effects of the measure on worker comfort and productivity are discussed in the appendices. DOE

N80-11594# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.

REGENERATIVE FLYWHEEL ENERGY STORAGE SYSTEM

E. L. Lustenader, I. H. Edelfelt, D. W. Jones, A. B. Plunkett, E. Richter, and F. G. Turnbull 1979 30 p refs

(Contract W-7405-eng-48)

(UCRL-13982) Avail: NTIS HC A03/MF A01

The current status of a program to develop and evaluate a regenerative flywheel energy storage system is described. The system was designed for a battery/flywheel electric vehicle in the 3000 pound class. DOE

N80-11595# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

INEL GEOTHERMAL ENVIRONMENTAL PROGRAM Annual Report, 1978

Susan G. Spencer, J. F. Sullivan, and N. E. Stanley Apr. 1979
65 p refs

(Contract EY-76-C-07-1570)

(TREE-1340) Avail: NTIS HC A04/MF A01

The monitoring and research efforts were conducted to characterize the beneficial and detrimental impacts resulting from the development of moderate temperature geothermal resources in the Raft River Valley. DOE

N80-11596# Los Alamos Scientific Lab., N. Mex.

NIGHT STORAGE AND BACKUP GENERATION WITH ELECTROCHEMICAL ENGINES

G. R. B. Elliott and N. E. Vanderborgh 1978 15 p Presented at Solar Thermal Test Facilities Users Assoc. Meeting, Golden, Colo., 11 Apr. 1978

(Contract W-7405-eng-36)

(LA-UR-78-1149; Conf-780447-1)

HC A02/MF A01

The design of Li-I2 electrochemical engines which both store and generate electric power is described. The conversion of heat energy to electrical energy in the electrochemical engines is examined. The laboratory performance of electrochemical engines based on the Li-I2 chemical system is discussed. The calculations for the expected performance of particular Li-I2 electrochemical engines used for storage and for each solar to electric conversion path are presented. A.W.H.

N80-11598# Midwest Research Inst., Golden, Colo.

PROCEEDINGS: SOLAR THERMAL POWER USER REVIEW PANEL MEETING

Mar. 1979 33 p Conf. held 1-2 Mar. 1979

(Contract EG-77-C-01-4042)

(SERI/TP-69-221) Avail: NTIS HC A03/MF A01

Solar Energy Research Institute presentations on (1) the R&D mission in Solar Thermal technology; (2) TID management and organization; and (3) target audience characteristics are reviewed. Synopses of discussions on target audience needs are included. DOE

N80-11599# Ocean Data Systems, Inc., Monterey, Calif.

OTEC THERMAL RESOURCE REPORT FOR CARIBBEAN SEA PLANT SHIP 13-15 DEGREES N 75-80 DEGREES N

W. A. Wolff May 1979 41 p refs

(Contract ET-78-C-01-2898)

(HCP/T2898) Avail: NTIS HC A03/MF A01

A large and consistent thermal resource which exists in the area between 13-15 deg North latitude and 75-80 deg West longitude, was studied for possible use by a plant ship. The area is primarily in the Colombian Basin of the Caribbean Sea. The average annual delta T (surface temperature minus temperature at depth) for the area at 1000 meters is 22.4 C. At 650 meters, an adequate delta T exists, with no month of the year having a mean delta T less than 19 C. The total variability of temperature at all depths in this Caribbean area is small. Below 1000 meters, the total variation is extremely small. The area has a good mixed layer at all times of the year. It is occasionally exposed to strong winds from hurricanes. Currents generally show the same general pattern throughout the year with a predominant flow toward the west or northwest at average speeds of 40-50 cm/sec. DOE

N80-11601# Department of Energy, Washington, D. C. Energy Information Administration.

RESIDENTIAL SECTOR ENERGY FORECASTS, NATIONAL LEVEL FOR 1978-ELECTRICITY, NATURAL GAS, NUMBER TWO FUEL OIL AND PROPANE

P. DonVito and H. Walton Mar. 1979 23 p refs

(DOE/EIA-0102/50) Avail: NTIS HC A02/MF A01

Methods and results of estimating the average 1978 price of fuels used in the residential sector are given. Average (as opposed to marginal) prices were requested and are given for electricity, natural gas, No. 2 fuel oil, and propane. The projected

1978 average fuel prices resulting from the analysis are: electricity, 4 cents/kWh; natural gas, 27.5 cents/therm; No. 2 fuel oil, 49.2 cents/gallon; and propane, 44.9 cents/gallon. Regional and seasonal variations are not discussed here. DOE

N80-11602# Midwest Research Inst., Kansas City, Mo.

STATUS OF INFORMATION FOR CONSUMERS OF SMALL WIND ENERGY SYSTEMS

P. Weis Feb. 1979 19 p refs Presented at the Symp. on Commercialization of Solar and Conserv. Technol., Miami Beach, Fla., 11 Dec. 1978

(Contract EG-77-C-01-4042)

(SERI/TP-51-158; Conf-781235-3)

HC A02/MF A01

Avail: NTIS

Research efforts, existing information sources, and ongoing work to improve data necessary for potential consumers of small wind energy conversion systems are presented. DOE

N80-11603# Monsanto Research Corp., Dayton, Ohio.

ENERGY STORAGE FOR SOLAR AIR CONDITIONING APPLICATIONS UTILIZING A FORM-STABLE, HIGH DENSITY POLYETHYLENE PELLET BED

R. B. Whitaker, G. H. Jenkins, G. L. Ball, and I. O. Salyer (Dayton Univ. Res. Inst.) 1979 10 p refs Presented at the Solar Energy Storage Options Workshop, San Antonio, Tex., 18 Mar. 1979

(Contract EY-76-C-04-0053)

(MLM-2598(OP); Conf-790328-1)

HC A02/MF A01

Avail: NTIS

The results obtained from a cost effectiveness comparison of three different methods of crosslinking high density polyethylene (HDPE) to make it a form-stable, useful thermal energy storage (TES) material are presented in some detail. In addition, the projected costs of a proposed HDPE-liquid thermal transfer system are compared to those of other liquid and air thermal transfer TES systems operative in the same 100 to 150 C range. DOE

N80-11604# Stanford Linear Accelerator Center, Calif.

HYDROGEN-ELECTRIC POWER DRIVES

F. F. Hall Oct. 1978 10 p

(Contract EY-76-C-03-0515)

(SLAC-PUB-2203; Conf-781214-2)

HC A02/MF A01

Avail: NTIS

Hydrogen-electric power drives consist of most or all of the following: chilled hydrogen gas tank, liquid oxygen tank, a bank of fuel cells, dc/ac inverter, ac drive motors, solid state ac speed control, dc sputter-ion vacuum pumps, steam turbine generator set and steam condenser. Each component is described. Optional uses of low pressure extraction steam and warm condensate are listed. Power drive applications are listed. Impact on public utilities, fuel supplies, and users is discussed. DOE

N80-11605# Battelle Pacific Northwest Labs., Richland, Wash.

USER MANUAL FOR GEOCITY: A COMPUTER MODEL FOR GEOTHERMAL DISTRICT HEATING COST ANALYSIS

H. D. Huber, C. L. McDonald, and S. C. Schulte Oct. 1978

200 p refs

(Contract EY-76-C-06-1830)

(PNL-2742) Avail: NTIS HC A09/MF A01

A computer model called GEOCITY was developed to systematically calculate the potential cost of district heating using hydrothermal geothermal resources. GEOCITY combines climate, demographic factors, and heat demand of the city, resource conditions, well drilling costs, design of the distribution system, tax rates, and financial factors into one systematic model. The GEOCITY program provides the flexibility to individually or collectively evaluate the impact of different economic and technical parameters, assumptions, and uncertainties on the cost of providing district heat from a geothermal resource. Both the geothermal reservoir and distribution system are simulated to model the complete district heating system. GEOCITY calculates the unit cost of energy and the unit cost of heat for the district heating system based on the principle that the present worth of

the revenues will be equal to the present worth of the expenses including investment return over the economic life of the distribution system. DOE

N80-11606# Fletcher (A. L.) and Associates, Gainesville, Fla.
ANALYSIS OF FINANCIAL PROGRAMS FOR ENERGY CONSERVATION: MARKET SIMULATION (PENETRATION) MODEL

G. S. Maddala, J. W. Milliman, and R. B. Roberts Aug. 1978
 273 p refs
 (Contract EC-76-C-01-8662)
 (HCP/M8662-1) Avail: NTIS HC A12/MF A01

A simulation model was developed to evaluate the effects of Federal financial-incentive programs. Specifically the model was developed for two industries: primary metals and stone, clay, and glass. The model is designed to be a link between existing macro models of the economy and micro engineering models. The model is also designed as a prototype that could be easily adapted to a variety of industries. The model, as currently developed, performs the following major functions: (1) evaluates the impact of different financial incentive programs on the rate of market penetration of energy-saving technologies; (2) estimates the energy saved over-time because of these programs; (3) estimates the change in energy efficiency of the capital stock because of these programs; (4) estimates the value of the energy saved and the cost to the government of the program; and (5) calculates the social benefits and costs of the program. DOE

N80-11607# Fluor Engineers and Constructors, Inc., Irvine, Calif.
HEBER GEOTHERMAL DEMONSTRATION POWER PLANT Interim Report, Aug. 1977 - Jan. 1978

Aug. 1978 67 p refs Sponsored in part by San Diego Gas and Electric Company
 (EPRI Proj. 580-2)
 (EPRI-ER-863; IR-1) Avail: NTIS HC A04/MF A01

The work performed from August 1977 through January 1978 pertinent to the design of the demonstration plant is reported. The Heber project objective is to design, construct and operate a power plant to produce a net power output of 45 MW/sub e/, deriving energy from a low-salinity, moderate temperature (360 F, 182 C) brine heat source available from the Heber geothermal reservoir. A binary cycle conversion system employs a light aliphatic hydrocarbon mixture to derive heat from the brine supply, through heat exchangers, and drive the turbine-generator to produce power. Power output will be distributed to California's Imperial Valley. DOE

N80-11608# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE DEVELOPMENT. PHASE 1: DESIGN REQUIREMENTS

E. C. Snow and R. W. Zocher Sep. 1979 24 p refs
 (Contract W-7405-eng-36)
 (LA-7385-SR) Avail: NTIS HC A02/MF A01

Studies were performed to determine the necessary design requirements for a PuO₂ General Purpose Heat Source (GPHS). Systems and missions applications, as well as accident conditions, were considered. The results of these studies, along with the recommended GPHS design requirements, are presented and discussed. DOE

N80-11609# Addis Translations International, Portola Valley, Calif.
CONVERSION OF RADIANT ENERGY INTO CHEMICAL ENERGY

G. Calzaferri Nov. 1978 44 p refs Transl. into ENGLISH from Chimia, Switzerland, v. 32, no. 7, Nov. 1978 p 241-253 (UCRL-Trans-11427) Avail: NTIS HC A03/MF A01

The conversion of light into chemical energy as well as the conversion of chemical energy into light leads to exciting speculations and experiments. Reversible photoredox reactions appear to be the most promising chemical system for converting solar energy into chemical or electrochemical energy. Finding selective electrode material in photogalvanic cells is one of the problems to be solved. Selective electrode material for Fe(+3)/sub sq/Fe(+2)/sub sq was found in the thionine/iron system as well as in the iodine/iron system. Attention should now be focused

on reversible two or more photon processes at low light intensities because cleavage of water in the visible region cannot be done with one photon. DOE

N80-11612# Transportation and Economic Research Associates, Inc., Arlington, Va.

DISAGGREGATING PIES FUEL FORECASTS, VALIDATING PIES TRANSPORTATION MODEL DATA BASE, AND OTHER TECHNICAL SERVICES

15 Sep. 1978 84 p
 (Contract EC-77-C-01-8578)
 (TID-29000) Avail: NTIS HC A05/MF A01

Three research tasks concerned with modifications and/or alterations to the PIES (Project Independence Evaluation System) and one auxiliary research task are reported. The first task, a modification to the transportation data base for petroleum refining regions, was necessitated by a proposed change of the present seven refining districts to ten refining districts. Five of the Standard Tables on transportation costs required changes. Tariffs and route descriptions are given in interregional pipeline rates for crude oil and petroleum products. Pipeline tariffs and tanker costs for distribution of Alaskan oil to PIES refining regions are tabulated. In the second task the structure of the coal transportation submodel in PIES was changed by building a simplified transshipment network which makes it possible to easily track coal from the mine to the point of use. The third task is a brief description of natural gas rates and rate making practices in the U.S. The fourth task analyzes differences in actual wholesale prices in various other locations in a region (as opposed to the PIES centroid) with respect to the differences in transportation costs. DOE

N80-11613# Sandia Labs., Albuquerque, N. Mex. Midtemperature Solar Systems Test Div.

MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF) PROJECT TEST RESULTS: PHASE 4A MSSTF SYSTEM OPERATION

Thomas D. Harrison and William H. McCulloch Nov. 1978 53 p refs
 (Contract EY-76-C-04-0789)
 (SAND-78-1088) Avail: NTIS HC A04/MF A01

The results of testing the Department of Energy's Midtemperature Solar Systems Test Facility (MSSTF) at Sandia Laboratories, Albuquerque, New Mexico are summarized. The system is a dispersed power system that collects solar energy and supplies both the electrical and thermal energy demands of a representative load. Testing was done between July 1976 and March 1978. The Phase IVA MSSTF studied consists of: (1) a 200-m sq m (2160-sq ft) east-west parabolic trough collector field subsystem, which collects a measured 431-kWh thermal on a typical winter day and as estimated 483 kWh on a typical summer day; (2) a high-temperature thermocline storage subsystem, capable of storing 278-kWh thermal energy in Therminol 66 between 240 C and 310 C; (3) fluid-transfer equipment, including piping, pumps, and valves; (4) a prime-mover subsystem (toluene heat exchanger and turbine/generator) to convert thermal energy to electrical energy; and (5) a control and data-acquisition system. A brief description of each of these elements is given, and test results are reported. DOE

N80-11614# California Univ., Berkeley. Lawrence Berkeley Lab.

ENERGY CONSERVATION: POLICY ISSUES AND END-USE SCENARIOS OF SAVINGS POTENTIAL PART 3: POLICY BARRIERS AND INVESTMENT DECISIONS IN INDUSTRY

Sep. 1978 54 p
 (Contract W-7405-eng-48)
 (LBL-7896-Pt-3) Avail: NTIS HC A04/MF A01

Industrial decision making was investigated with respect to energy conservation. It was concluded that government policy could be formulated to encourage conservation investments, but government intervention should be limited to those situations where it is both necessary and likely to be effective. To assist policy makers in understanding the industrial decision making

process and recognizing the factors which prevent a measure from being adopted, a methodology is developed that can be applied to most conservation measures in all industrial subsectors. The methodology is summarized in two flow charts and a matrix. DOE

N80-11615# Institute of Gas Technology, Chicago, Ill.
INFLUENCE OF ELECTROLYTE COMPOSITION ON ELECTRODE KINETICS IN THE MOLTEN CARBONATE FUEL CELL

P. Ang and A. F. Sammells 1978 30 p refs Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh, Pa., 15-20 Oct. 1978; sponsored by the Electrochem. Soc., Inc. (Contract EM-78-C-03-1735) (CONF-781063-2) Avail: NTIS HC A03/MF A01

Electrode Kinetics for fuel oxidation on nickel and cobalt electrodes is discussed for three selected molten carbonate mixtures. Activation kinetics under the probable mixed-control conditions present in the electrochemical half-cell were determined using a potential step technique. With all melts, the highest exchange current values were found on nickel anodes, and the highest of these values were found for the melt comprised of 43.5 mole percent Li_2CO_3 31.5 mole percent Na_2CO_3 25 mole percent K_2CO_3 . For this ternary melt the exchange current density on nickel varied from 78 mA/sq cm for intermediate-Btu fuel to 22 mA/sq cm for low-Btu fuel at 650 C. The exchange current density was found to have a reaction order of around 0.25 for hydrogen, carbon dioxide, and water. Electrochemical performance on the two anode materials in the three melts is discussed, and a tentative reaction mechanism for the oxidation reaction is suggested. DOE

N80-11616# Los Alamos Scientific Lab., N. Mex.
ENERGY SAVINGS FOR A SOLAR HEATED AND COOLED BUILDING THROUGH ADAPTIVE OPTIMAL CONTROL

D. R. Farris and James L. Melsa Nov. 1978 9 p refs Presented at IEEE Conf. on Decision and Control, San Diego, Calif., 10 Jan. 1979 Prepared in cooperation with Notre Dame Univ. (Contract W-7405-eng-36) (LA-UR-78-2986; Conf-790105-1) Avail: NTIS HC A02/MF A01

The applicability of adaptive and optimal control techniques to the control of heating, ventilating, and air conditioning systems of solar heated and cooled buildings is described. The suitability of optimal and adaptive concepts is discussed and the selected approach is explained. An integral quadratic cost functional to define optimal performance and an identification process to produce a linearized building model are discussed. The building model is described and heating system simulations of three versions of the adaptive optimal controller are reported along with a simulation of a conventional controller for comparison. DOE

N80-11617# Midwest Research Inst., Golden, Colo.
RESEARCH OVERVIEW OF BIOLOGICAL AND CHEMICAL CONVERSION METHODS AND IDENTIFICATION OF KEY RESEARCH AREAS FOR SERI Final Report

T. A. Milne, John S. Connolly, Robert E. Inman, Thomas B. Reed, and Michael Seibert Sep. 1978 75 p refs (Contract EG-77-C-01-4042) (SERI/TR-33-067) Avail: NTIS HC A04/MF A01

The current and future research areas of the biological and chemical conversion branch is presented. Energy and petrochemical substitutes from biomass, thermochemical conversion, and photoconversion are research areas examined. DOE

N80-11618# California Univ., Livermore. Lawrence Livermore Lab.

MATERIALS PROGRAM FOR FIBER COMPOSITE FLYWHEELS

J. A. Rinde 10 Oct. 1978 13 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978 (Contract W-7405-eng-48) (UCRL-81724; Conf-781046-9) Avail: NTIS HC A02/MF A01

A rubberized epoxy resin that offers improved fracture toughness and suitable performance at moderately elevated temperatures (up to 70 C) and six epoxy resins for service at 150 C were evaluated. In addition, the rubberized epoxy resin was used as a matrix in Kevlar 49 composites and engineering design data were generated. Stress rupture tests were initiated on E-glass composites at load levels of 60% to 85% of short term strength. Dynamic fatigue tests on Kevlar 49 composites in the tension-tension mode and fatigue tests on a Kevlar 49 composite ring specimen at 50% to 75% ultimate strength were begun. DOE

N80-11619# Argonne National Lab., Ill.
PRELIMINARY MATERIALS ASSESSMENT IN SOLAR DEMONSTRATION SYSTEMS

C. F. Cheng Nov. 1978 29 p refs Presented at the ASME Energy Technol. Conf., Houston, Tex., 5 Nov. 1978 (Contract W-31-109-eng-38) (ANL/EES-CP-30; Conf-781112-8) Avail: NTIS HC A03/MF A01

Materials performance in solar demonstration systems is assessed from published literature and service experience. The solar demonstration systems and the materials used in the collector and transport systems are summarized. DOE

N80-11620# Chalmers Univ. of Technology, Goteborg (Sweden). Institutionen foer Fysik.

SPECTRALLY SELECTIVE SURFACES WITH COATINGS COMPRISED OF ULTRAFINE METAL PARTICLES

C. G. Granqvist 1978 15 p refs Presented at the Symp. on Solar-Thermal Power Stations, Cologne, 12 Apr. 1978 (AED-Conf-78-212-004; Conf-780425-7) Avail: NTIS HC A02/MF A01

Efficient photothermal conversion of solar energy requires high absorption at wavelengths $\lambda > \lambda_{\text{sub } c/}$ and low absorption at $\lambda > \lambda_{\text{sub } c/}$, where $\lambda_{\text{sub } c/}$ is approximately 2 microm. Such spectrally selective surfaces can be prepared by coating metal plates with films consisting of ultrafine metal particles dispersed in an insulating matrix. Gas evaporated Cr particles with diameters approximately 10 nm were used. Spectrophotometry in the range $0.3 < \lambda < 25$ microm displayed good spectral selectivity. The parameters governing the position of $\lambda_{\text{sub } c/}$ were determined. The crucial importance of the shape of the particles was documented, and, in general, increased eccentricity shifted $\lambda_{\text{sub } c/}$ toward larger wavelengths. A similar shift was obtained for nonhomogeneous spheres whose dielectric core size was enlarged. DOE

N80-11621# Department of Energy, Washington, D. C.
INTERNATIONAL COAL TECHNOLOGY SUMMARY DOCUMENT

Dec. 1978 113 p refs Prepared in cooperation with TRW, Inc., McLean, Va. (Contract EX-76-C-10-3885) (DOE/PE-0010; HCP/P3885) Avail: NTIS HC A06/MF A01

The status of coal technologies expected to be available for commercial application by 1990 is reviewed. Technologies discussed include direct combustion using flue gas desulfurization, fluidized bed combustion, gasification, liquefaction, and advanced power cycles. Coal mining and transportation are also reviewed. Social, environmental, safety, and health constraints on coal use are considered. K.L.

N80-11622# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

LATERAL AND TILT WHIRL MODES OF FLEXIBLY MOUNTED FLYWHEEL SYSTEMS

C. W. Bert and T. L. C. Chen Dec. 1978 36 p refs Presented at the 49th Shock and Vibration Symp., Washington, D. C., 17-19 Oct. 1978 Prepared for Sandia Labs. (Contract EY-76-C-04-0789) (SAND-78-7070; OU-AMNE-78-5; Conf-7810154-1) Avail: NTIS HC A03/MF A01

High performance, composite material flywheel systems were driven by an air turbine at the Sandia Livermore spin test facility. An analysis of the systems considering six degrees of freedom was applied to two versions of a specific design. DOE

N80-11623# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

WHIRLING RESPONSE AND STABILITY OF FLEXIBLY MOUNTED, RING-TYPE FLYWHEEL SYSTEMS

T. L. C. Chen and C. W. Bert Nov. 1978 122 p refs (Contract EY-76-C-04-0789)

(SAND-78-7073; OU-AMNE-78-6) Avail: NTIS HC A06/MF A01

Rim type composite material flywheels are examined. Free whirling, stability, and forced whirling are examined for these fly-wheel systems. In the free whirling analysis, predicted critical speeds are encountered in the design operating speed range. Practical ways to increase such critical speeds are suggested. Effects of material internal damping on the stability of the system are discussed. DOE

N80-11624# Argonne National Lab., Ill.

UNDERGROUND PUMPED HYDRO STORAGE: AN OVERVIEW

S. W. Tam, C. A. Blomquist, and G. T. Kartsounes 1978 13 p refs Presented at the 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978

(Contract W-31-109-eng-38) (CONF-781046-1) Avail: NTIS HC A02/MF A01

The status of underground pumped hydro storage (UPHS) for electric utility peaking and energy storage applications is reviewed. The salient features of major recent studies are reviewed. Turbomachinery options and advances in high head pump/turbines are discussed. The effect of head, capacity, turbomachinery unit size and type, and other performance variables on the cost of a UPHS plant are presented. Market potential, siting criteria, lower reservoir construction, and geological related issues are addressed. The environmental impact of a UPHS plant is reduced from comparable facilities, and these issues and other safety concerns are presented. DOE

N80-11626# Williams (O. G.) and Skaggs (R. L.), Las Vegas, Nev.

SOLAR PARABOLIC TROUGH FORMING PROCESS Final Report

O. G. Williams and R. L. Skaggs 31 May 1978 58 p refs (Grant EG-77-G-04-4158)

(ALO-4158-1) Avail: NTIS HC A04/MF A01

A new forming process is presented which exceeds an 8/1 concentration. Expanding on work previously done, many variables were investigated. Using one foot long trough samples, a high degree of slope accuracy was obtained. The forming process eliminated the need for ribs, boxes or other devices now used to maintain the parabolic shape of a solar parabolic shell. The process, in brief, involves (1) alloy aluminum; (2) moments; (3) temperature; (4) time; (5) thickness; (6) bearings; (7) flange angle bend; (8) hardness; (9) lengthwise sag; (10) material flatness; and (11) aperture control. DOE

N80-11627# Lincoln Lab., Mass. Inst. of Tech., Lexington.

MAXIMUM POWER TRACKERS FOR PHOTOVOLTAIC ARRAYS

E. E. Landsman 1977 6 p refs Presented at the 13th IEEE Photovoltaic Specialists' Conf., Washington, D. C., 5-8 Jun. 1978

(Contract EY-76-C-02-4094)

(COO-4094-17) Avail: NTIS HC A02/MF A01

Progress is reported on the following tasks: agriculture applications; Natural Bridges National Monument, rooftop test bed; Chicago Museum of Science and Industry; data management; materials, processes, and testing, and power conditioning and handling. DOE

N80-11628# Argonne National Lab., Ill. Energy and Environmental Systems Div.

DESIGN OPTIMIZATION OF AQUIFER RESERVOIR-BASED COMPRESSED AIR STORAGE SYSTEMS

Frederick W. Aherns 1978 12 p refs Presented at the Mech. and Magnetic Energy Storage Contractors' Inform. Exchange Conf., Luray, Va., 24-16 Oct. 1978

(Contract W-31-109-eng-38)

(CONF-781046-5) Avail: NTIS HC A02/MF A01

The application of a general compressed air energy storage (CAES) power system design optimization methodology to the class of CAES plants having aquifer air storage reservoirs is discussed. Performance and economic models for the aquifer reservoir, wells, piping, and air compression system are described. Identification of designs which minimize the subsystem power generation cost, while satisfying constraints related to the geology, equipment, and utility load curve are presented. The design specification resulting from the optimization procedure includes: land area to be purchased, well depth, number of wells, well spacing, wellbore diameter, main pipeline diameter, required compressor system power and discharge pressure, and required compression time durations for each day of the week. DOE

N80-11630# Gesellschaft fuer Wirtschaftliche Bautechnik m.b.H., Munich (West Germany). Inst. fuer Angewandte Bauforschung. **INVESTIGATION OF THE APPLICABILITY OF TECHNICAL SYSTEMS UTILIZING SOLAR ENERGY FOR THE HEAT SUPPLY OF BUILDINGS Final Report**

Josef Franz Holbl and Hannes Krack Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 240 p refs In GERMAN; ENGLISH summary

(Contract BMFT-ET-4056-A)

(BMFT-FB-T-78-48) Avail: NTIS HC A11/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Ger. DM 50.40

The use of solar energy to heat German army barracks was studied. Possibilities for the installation of solar energy systems for heating water and for general heating purposes were considered. Information on available building types, their construction, and intended use, as well as climatic parameters, was compiled. Four categories were analyzed. Results indicate that energy costs can be reduced by between 40 percent to 55 percent in the case of barracks. It is recommended to install four solar heating systems, two in buildings with flat roofs and two in buildings with pitched roofs. It is intended to study the influence of roof type on heating efficiency. Author (ESA)

N80-11631# Stockholm Univ. (Sweden). Dept. of Meteorology.

INTERACTION IN LIMITED ARRAYS OF WINDMILLS: REVIEW OF EARLIER RESULTS FROM A SIMPLE MODEL AND A PRESENTATION OF THE CAPABILITIES OF A DYNAMIC PBL MODEL

Carl Crafoord 27 Mar. 1979 57 p refs Prepared in cooperation with Intern. Meteorol. Inst.

(DM-26) Avail: NTIS HC A04/MF A01

The problem of how closely packed an array of windmills can be erected without unduly interfering with each other is considered. A general technical background for the behavior of a single windmill in a homogeneous flow, together with a list of important parameters for the general performance of a group, is given. Earlier results for neutral stratification are reviewed and presented in a slightly different manner more fully illustrating the trade-off between windmill density and mean efficiency as function of group size. The analogy between plumes and wakes as a basis for a model formulation is reviewed. Preliminary results indicate a variation in mean efficiency of 13% for a group with 80 units, which may correspond to a factor of 2.5 in area coverage. A dynamic one dimensional planetary boundary layer model is presented and redesigned for simulation experiments. Using it, the regeneration of the wind profiles behind a windmill unit is studied for different ambient conditions. Preliminary results indicate a variation of up to a factor of 9 in the rate of regeneration of the profiles. How this data might be considered in a statistical analysis is discussed. Author (ESA)

N80-11632# Austrian Solar and Space Agency, Vienna.

SOLAR ENERGY WITH LATENT HEAT STORAGE: FUNDAMENTALS AND APPLICATIONS [SONNENERGIE.

LATENTSPEICHER. GRUNDLAGEN UND ANWENDUNGEN]

Oct. 1978 78 p refs In GERMAN; ENGLISH summary (ASSA-10/1978) Avail: NTIS HC A05/MF A01

Solar heating systems are examined in terms of their year-round efficiency. The desirability of storing the surplus of solar energy in summer for the heating period autumn and winter is mentioned. Possible storage schemes, such as water storage, ground storage, and latent heat storage, are examined. It is shown that water and ground as storage mediums have only small thermal storage capacity and, therefore, need large volumes. As far as latent-heat-storage is concerned, a phase-conversion (solid to liquid) is caused by the supply of heat and this process is reversed again by the withdrawal of heat. Thus, the heat is being stored in the form of conversion energy and the storage volumes become considerably lower since the energy density is much higher. Possible media for latent storage are compiled and their features described. The present state of technology is explained by illustrating applications. Economic aspects and conclusions are presented. Author (ESA)

N80-11633# Environmental Law Inst., Washington, D. C.
**SOLAR ACCESS LAW. PROTECTING ACCESS TO
 SUNLIGHT FOR SOLAR ENERGY SYSTEMS**

Gail Boyer Hayes May 1979 173 p refs Sponsored in part by DOE

(Grant HUD-H-8213G)

(PB-296532/5) Avail: NTIS HC A08/MF A01 CSCL 10A

Legal strategies to assure that owners of solar energy systems receive sunlight on their collectors are evaluated. The protection of solar access in developed urban and suburban areas is emphasized. Recommendations are made and conclusions are reached about laws and zoning and land use regulations that offer the best protection of solar rights. K.L.

N80-11634# National Field Research Center, Inc., Iowa City, Iowa.

**NATIONAL ENVIRONMENTAL/ENERGY WORKSHOP
 ASSESSMENT, PHASE 3. ENERGY PROGRAMS
 Final Report**

Aug. 1979 106 p

(Grant EPA-T-900591-03)

(PB-298587/7; EPA-600/8-79-023H) Avail: NTIS
 HC A06/MF A01; also available in set of 18 reports PC E99.
 PB-298579-SET CSCL 05I

In addition to well-established programs in nuclear engineering, mining, petroleum and natural gas technology and engineering, there are programs in energy conversion, energy engineering and policy, energy conversion and resources, energy resources management, and several others which represent recent innovative approaches to the broad spectrum of energy problems. GRA

N80-11639# Brookhaven National Lab., Upton, N. Y. Process, Sciences Div.

**ENVIRONMENTAL CONTROL TECHNOLOGY FOR CARBON
 DIOXIDE**

Meyer Steinberg, A. S. Albanese, and Vi-Duong Dang Sep. 1978 36 p refs Presented at the 71st Ann. Meeting of the Am. Inst. of Chem. Engr., Miami, Fla., 12-16 Nov. 1978 (Contract EY-76-C-02-0016)

(BNL-24999; Conf-781110-10) Avail: NTIS
 HC A03/MF A01

Routes for removal, recovery, disposal, and reuse of CO₂ from various control points in the global system are reviewed. The energy and mass balances for various routes are used as a criteria for evaluation. Alternative energy sources are assessed as a means of control. DOE

N80-11641# Los Alamos Scientific Lab., N. Mex.
**ENERGY DEVELOPMENT vs WATER QUALITY IN THE
 UPPER COLORADO AND UPPER MISSOURI RIVER
 BASINS**

A. B. Bishop, S. L. Klemetson, M. F. Torpy, and M. McKee Oct. 1978 84 p refs

(Contract W-7405-eng-36)

(LA-7497-MS) Avail: NTIS HC A05/MF A01

Impacts from energy developments are discussed in terms of the various pollutants generated by energy extraction and processing activities, and the pollution transport mechanisms and pathways by which they can enter surface and groundwater. The implications for energy development of the water quality aspects of legislative requirements and regulations are discussed. Many of the potential water pollution problems associated with energy development will occur through the transport of pollutants from air pollution and solid waste disposal. The consumptive use of all water withdrawn for energy processing as a pollution control measure raises three important issues-each of which represents a potential conflict between energy developers compliance with the legislation and western water law: (1) junior rights and water transfer, (2) the beneficial use question, and (3) the reasonable use measure of certain water quality practices. DOE

N80-11647# IEA. Coal Research, London (England).

HOT GAS CLEANUP

G. F. Morrison Mar. 1979 53 p refs

(ICTIS/TR-03; ISBN-92-9029-017-X) Avail: NTIS
 HC A04/MF A01

The current technological status of hot gas cleanup systems for cleaning gases from coal gasifiers or fluidized bed combustors prior to their use in combined cycle power generating systems is reviewed. Self contained cleanup systems which can be applied to various gasifiers or combustors are emphasized. Contaminants in the gas stream are identified as sulphur compounds, particulates, nitrogen compounds, and trace elements. Hot gas desulphurization processes are classified according to the sorbent on which they are based (iron oxide or calcium). Particulate removal is subdivided according to the separation technique. Cyclones, surface and depth filters, and electrostatic precipitators are covered.

Author (ESA)

N80-11656# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.

**TECHNICAL ASSESSMENT OF THERMAL DeNOx PROCESS
 Final Report, Nov. 1977 - Dec. 1978**

C. Castaldini, K. G. Salvesen, and H. B. Mason May 1979 138 p

(Contract EPA-68-02-2611)

(PB-297947/4; EPA-600/7-79-117) Avail: NTIS
 HC A07/MF A01 CSCL 13B

The thermal deNO_x process applied to coal fired utility boilers is assessed. It is concluded that the process is a promising technique for controlling NO_x emissions. However, flue gas temperature fluctuations may limit NO_x reductions to approximately 50%. In addition, operational and environmental impacts of NH₃ emissions and ammonium bisulfate formation could further limit the performance of the process and effect is applicability. Costs depend primarily on boiler size, initial NO_x concentration, and level of control required. The impact of widespread process implementation on the ammonia market, feedstock supplies, and their costs are considered and found to be small. GRA

N80-11670# National Field Research Center, Inc., Iowa City, Iowa.

**NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE
 ASSESSMENT, PHASE 3. AIR PROGRAMS Final Report**

Aug. 1979 39 p

(Grant EPA-T-900591-03)

(PB-298580/2; EPA-600/8-79-023A) Avail: NTIS
 HC A03/MF A01; also available in set of 18 reports PC E99.
 PB-298579-SET CSCL 05I

Information on post-secondary environmental education programs in the United States is provided. Structured around information requests mailed to post-secondary education institutions, the directory provides the name and address of each institution listed, a contact person at each institution, the academic program title, and the degree offered at the institution (2-year, 4-year, etc.) Twelve such directories of post-secondary programs include: one each for air, noise, pesticides and toxicology.

potable water, wastewater, radiation, solid waste, and energy; one for combined water/wastewater programs; and a composite volume on each of the three areas of environmental engineering/technology, environmental science/health, and environmental studies. GRA

N80-11711# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

SEISMIC REFRACTION INVESTIGATION OF THE SALTON SEA GEOTHERMAL AREA, IMPERIAL VALLEY, CALIFORNIA M.S. Thesis

Robert Frith Bruce Dec. 1978 106 p refs

(Grant NSF AER-72-03551)

(PB-296547/3; UCR/IGPP-78/19; NSF/RA-780511) Avail: NTIS HC A06/MF A01 CSCL 08G

Seven seismic refraction profiles and four long refraction shots were used to investigate the Salton Sea geothermal in preparation for energy resource development. From the data, two models of the geothermal and adjacent area were proposed. GRA

N80-11747*# Battelle Columbus Labs., Ohio.

PRELIMINARY ASSESSMENT OF INDUSTRIAL NEEDS FOR AN ADVANCED OCEAN TECHNOLOGY

A. G. Mourad, K. M. Maher, J. E. Balon, A. G. Coyle, and J. A. Henkener 15 Oct. 1979 59 p refs

(Contract NASw-2800)

(NASA-CR-162435; BCL-OA-TFR-79-4)

Avail: NTIS

HC A04/MF A01 CSCL 08C

A quick-look review of selected ocean industries is presented for the purpose of providing NASA OSTA with an assessment of technology needs and market potential. The size and growth potential, needs and problem areas, technology presently used and its suppliers, are given for industries involved in deep ocean mining, petrochemicals ocean energy conversion. Supporting services such as ocean bottom surveying; underwater transportation, data collection, and work systems; and inspection and diving services are included. Examples of key problem areas that are amenable to advanced technology solutions are included. Major companies are listed. A.R.H.

N80-11889# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT SPACE NUCLEAR SAFETY PROGRAM AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report

R. D. Baker, comp. Sep. 1978 55 p

(Contract W-7405-eng-36)

(LA-7519-PR) Avail: NTIS HC A04/MF A01

Studies related to the use of (Pu-238)O₂ in radioisotopic power systems are reported. DOE

N80-11891# Technical Research Centre of Finland, Espoo. **EVALUATION OF NUCLEAR POWER PLANT SITING BY PROBABILISTIC ASSESSMENT OF ENVIRONMENTAL IMPACT Ph.D. Thesis - Helsinki Univ., Otaniemi, Finland**

Seppo Vuori 1978 20 p refs

(VTT-EN-24; ISBN-951-38-0704-5)

Avail: NTIS

HC A02/MF A01

A probabilistic consequence assessment model ARANO and the individual calculation schemes therein included are described. This assessment model was applied to the risk/benefit and cost/benefit analyses of the siting of nuclear power plants. In addition, some comparisons with alternative fossil-fuelled energy production scenarios are made. Results indicate the model gives useful data in these applications. Author (ESA)

N80-11935# Braun (C. F.) and Co., Alhambra, Calif.

EXPERIMENTAL ENTHALPIES FOR A MIXTURE OF 80 MOLE PERCENT ISOBUTANE IN ISOPENTANE Final Report

C. R. Koppany and J. M. Lenoir Mar. 1979 52 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 928-4)

(EPRI-ER-1034) Avail: NTIS HC A04/MF A01

Seven enthalpy isobars were measured for a nominal mixture of 80% isobutane/20% isopentane. A phase envelope was constructed for use in the design of a turbine expander and the heat exchangers for a geothermal power plant. The dew point values for the phase envelope are discussed for the region near the critical. DOE

N80-11941# Ohio Public Utilities Commission, Columbus.

DEMAND MANAGEMENT DEMONSTRATION PROJECT. STAGE 1: DEVELOPMENT OF RESIDENTIAL LOAD CHARACTERISTICS. STAGE 4: DEMONSTRATION OF RESIDENTIAL INCREMENTAL COST PRICING IMPLEMENTED BY TIME-OF-DAY METERING Final Report, Jan. 1979

Apr. 1979 144 p

(Contract EC-75-F-01-8072)

(HCP/B8072-01) Avail: NTIS HC A07/MF A01

Several load-management technologies were used in order to gather data necessary for further implementation, gain insight into customer reactions to the various techniques studied, and develop the computer codes necessary to process such data. The results are consistent with economic theory and will contribute to the further development of effective pricing structures for electricity. The customers on the time-of-day rate responded by reducing their peak-period consumption significantly below that of comparable control-group customers. Total energy use by customers in the pricing group declined about 3.5%. Customers in the time-of-use and radio-controlled groups reacted favorably to the techniques. DOE

N80-11946# California Univ., Berkeley. Lawrence Berkeley Lab.

A MANUAL FOR CATALOGING AND INDEXING DOCUMENTS

S. R. Schwartz, S. L. Phillips, and J. J. Perra Jul. 1978 85 p refs Revised

(Contract W-7405-eng-48)

(LBL-4432-Rev-1) Avail: NTIS HC A05/MF A01

The descriptive cataloging and subject indexing rules and methodology needed to process bibliographic information for the National Geothermal Information (GRID) database storage are documented. Data elements which may appear in a bibliographic record are tabulated. Examples of coded data entry forms are included in an appendix. Examples are given of unit records in the database corresponding to one bibliographic reference. DOE

N80-11954*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **A SURVEY OF ELECTRIC AND HYBRID VEHICLE SIMULATION PROGRAMS Final Report**

J. Bevan, D. A. Heimbürger, and M. A. Metcalfe Nov. 1978 110 p refs

(Contract EC-77-A-31-1011)

(NASA-CR-162457; HCP/M1011-04)

Avail: NTIS

HC A06/MF A01 CSCL 13F

Results of a survey conducted within the United States to determine the extent of development and capabilities of automotive performance simulation programs suitable for electric and hybrid vehicle studies are summarized. Altogether, 111 programs were identified as being in a usable state. The complexity of the existing programs spans a range from a page of simple desktop calculator instructions to 300,000 lines of a high-level programming language. The capability to simulate electric vehicles was most common, heat-engines second, and hybrid vehicles least common. Batch-operated programs are slightly more common than interactive ones, and one-third can be operated in either mode. The most commonly used language was FORTRAN, the language typically used by engineers. The higher-level simulation languages (e.g. SIMSCRIPT, GPSS, SIMULA) used by 'model builders' were conspicuously lacking. DOE

N80-11965# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

SOUTHEASTERN FORUM ON APPROPRIATE TECHNOLOGY Final Report

Jeffrey S. Tiller, David S. Clifton, Jr., and Robert A. Cassanova
Apr. 1979 98 p Conf. held at Atlanta, Ga., 17-18 Sep. 1978
(Grant NSF ISP-78-22994)
(PB-298796/4; GIT-B-519-F; NSF/RA-790007) Avail: NTIS
HC A05/MF A01 CSCL 05A

The background and purpose of the forum are described as well as its structure and agenda. Results of the forum are presented and a strategy is proposed for NSF to follow in an appropriate technology program. The specific appropriate technologies that participants believed had the greatest potential for widespread implementation were passive solar energy, cooperative community projects, waterless toilets, an AT extension service, active solar equipment, utilization of local material and human resources in energy, resource recovery plants, conversion of biomass to fuel, recycling centers, techniques for passive and active space cooling, photovoltaics and marketing cooperatives for small farms. GRA

N80-11991# Technical Research Centre of Finland, Espoo.
[REPORT ON FINNISH TECHNOLOGICAL ACTIVITIES]
Annual Report, 1978

1979 35 p Original contains color illustrations
Avail: NTIS HC A03/MF A01

Results of research and test programs in building, community, materials, processing, energy, and information processing technologies are reported. Specific topics covered include heat economy of buildings, road friction, plastics, lubricants, ceramics, metallic materials and metal production, biotechnology, food science, mineralogy, and measurement of impurities in flue gases. Other areas discussed include graphical processes, mechanical wood handling, ship building, nuclear engineering, measurement of electrical quantities, and data processing and transmission.

K.L.

N80-12106* Rockwell International Corp., Downey, Calif.
Space Div.

SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 4: SPS POINT DESIGN DEFINITION
Final Report

G. Hanley Apr. 1978 220 p 5 Vol.

(Contract NAS8-32475)

(NASA-CR-150683; SD-78-AP-0023-4-Vol-4) Avail: NTIS
HC A10/MF A01 CSCL 22B

The satellite power systems point design concept is described. The concept definition includes satellite, ground and space systems, and their relationships. Emphasis is placed on the definition of the GaAlAs photovoltaic satellite system. The major subsystems of the satellite system including power conversion, power distribution and control, microwave, attitude control and stationkeeping, thermal control, structures, and information management and control are discussed.

A.W.H.

N80-12147# Hanford Engineering Development Lab., Richland, Wash.

MATERIALS COMPATIBILITY IN LIQUID SODIUM

W. F. Brehm Aug. 1978 38 p refs Presented at NACE
Conf., Denver, Colo., 3 Oct. 1978

(Contract EY-76-C-14-2170)

(HEDL-SA-1559; Conf-781071-2)

Avail: NTIS

HC A03/MF A01

The types and rates of reaction of sodium with reactor materials are presented. Confident predictions on the corrosion behavior for steel in sodium were obtained. Deposition phenomena are not well defined, at least with respect to establishing quantitative correlation. The potential uses of liquid metal heat transfer systems in energy conversion systems other than nuclear reactors were considered.

DOE

N80-12163# International Nickel Co., Inc., Suffern, N. Y. Inco
Research and Development Center.

EVALUATION OF HIGH CHROMIUM OVERPLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly
Report, 1 Mar. - 31 May 1978

E. P. Sadowski 1978 32 p

(Contract EF-77-C-01-2621)

(FE-2621-3) Avail: NTIS HC A03/MF A01

Three-quarters of the welding is complete and pre-exposure testing started on one-half of the completed weldments in this program to produce overlays resistant to corrosion in coal gasification atmospheres at 982 C. The welding processes were: submerged-arc, gas metal-arc and gas tungsten-arc with a hot wire addition. Pre-exposure testing was continued. The tests consisted of hardness surveys, bend, tensile, stress-rupture, bulk chemical analysis of the overlay and microprobe analysis for the distribution of major alloying elements from the outside edge of the overlay to the center of the base plate. The results are described.

DOE

N80-12188 Utah Univ., Salt Lake City.
ELUCIDATION OF COAL STRUCTURAL COMPONENTS BY SHORT RESIDENCE-TIME EXTRACTIVE LIQUEFACTION
Ph.D. Thesis

Doonee Kang 1979 202 p

Avail: Univ. Microfilms Order No. 7925040

Short contact time thermal reactions of bituminous coals with tetralin in hydrogen atmosphere were studied to ascertain the nature of the reaction such as the mechanism of the coal liquefaction process, the labile functional structures in the coal and the products, the hydrogen transfer reactions between coal and tetralin, and the kinetics of coal conversion. Yield and kinetic data indicated reaction paths of the coal conversion. A hybrid kinetic model containing first and second order rate equations was developed and tested for the data.

Dissert. Abstr.

N80-12189# Toronto Univ. (Ontario). Inst. for Aerospace
Studies.

THE FUTURE ROLE OF HYDROGEN FUEL IN AN ELECTRICAL SOCIETY

Gordon N. Patterson Oct. 1979 30 p refs

(UTIAS-241; CN-ISSN-0082-5255)

Avail: NTIS

HC A02/MF A01

The manufacture, storage, and use of hydrogen for peak-shaving purposes, vehicular power plants, and as a chemical raw material are discussed and programs for future development are indicated. It is concluded that plans for the future use of hydrogen on a large scale should be initiated now.

M.M.M.

N80-12191# Texaco, Inc., El Monte, Calif. Montebello Research
Lab.

GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION. EVALUATION OF SRC 2 VACUUM FLASH DRUM BOTTOMS FROM POWHATAN COAL AS A FEEDSTOCK FOR THE TEXACO GASIFICATION PROCESSES

A. M. Robin Mar. 1979 10 p

(Contract EX-76-C-01-2247)

(FE-2247-2) Avail: NTIS HC A02/MF A01

A 20 pound sample of vacuum flash drum bottoms, obtained from the liquefaction of Powhatan coal, was judged to be a suitable feedstock for a synthesis gas generation process. It can be charged directly to the gasifier at a temperature of about 615 F. The material is too viscous to be pumped with the pilot plant equipment, however, which is capable of maintaining a temperature of only 515 F. The addition of 3 to 5 percent cutter is required for the pilot plant tests. No cutter is required for a commercial plant. Based on these results, operating conditions and yields were estimated for gasifying 1000 pounds per hour of molten undiluted residue at 350 psig. A Type 2 preliminary pilot plant evaluation is planned.

DOE

N80-12192# Babcock and Wilcox Co., Alliance, Ohio. Research
Development Div.

CHARACTERIZATION AND COMBUSTION OF SRC 2 FUEL OIL Final Report

W. Downs and A. J. Kubasco Jun. 1979 131 p refs

(EPRI-FP-1U28) Avail: NTIS HC A07/MF A01

An industrial boiler rated at a steam flow of 45,000 lbs/hr was used for combustion tests of solvent refined coal (SRC) fuel oil, No. 2 fuel oil, and No. 5 fuel oil. Operating variables included

load, excess air, and burner register settings. The laboratory fuel analyses indicates that in most respects this SRC fuel oil sample behaved similarly to No. 2 fuel oil. The combustion test confirms that SRC fuel oil burns similarly to No. 2 fuel oil with one notable exception. NO/sub x/ emissions were substantially higher than for either the No. 2 or No. 5 fuel oils. The SRC fuel oil will require the application of NO/sub x/ combustion control techniques to meet the proposed New Source Performance Standards of 0.5 pound NO2/million Btu when burned in power boilers equipped with wall-mounted burners. DOE

N80-12197# Los Alamos Scientific Lab., N. Mex.
LASL THERMOCHEMICAL HYDROGEN PROGRAM STATUS ON OCTOBER 31, 1978

K. E. Cox and M. G. Bowman 31 Oct. 1978 9 p refs Presented at Chem. Hydrogen Energy Systems Contracts Rev., Washington, D.C., 28 Nov. 1978

(Contract W-7405-eng-36)

(LA-UR-78-2895; CONF-781142-4)

Avail: NTIS

HC A02/MF A01

Progress is reported in developing an efficient and economical thermochemical cycle for the production of hydrogen from water utilizing thermal energy sources that become available. Topics covered include: (1) continuing experiments in sulfate decomposition, sulfate formation, and hydrogen iodide electrolysis; (2) fusion-synfuel study (hydrogen); and (3) evaluation of thermochemical cycles. DOE

N80-12198# Oklahoma State Univ., Stillwater. Dept. of Chemistry.

CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY. MASS SPECTROMETRY AND FOSSIL-ENERGY CONVERSION TECHNOLOGY: A REVIEW Quarterly Report, 30 Mar. - 29 Jun. 1978

S. E. Scheppele 1978 141 p

(FE-2537-7) Avail: NTIS HC A07/MF A01

The following activities in regard to the development of micromolecular probe distillation in combination with field-ionization mass spectrometry (FI/MS) for quantitative analysis are reported. The temperature-control module for the direct-introduction probe was received and successfully interfaced to both the probe and the NOVA 3/12. Both temperatures and FI/MS data were minicomputer acquired for probe distillation of a 19 component synthetic blend, an asphaltene-acid fraction, and the base fraction from an anthracene-oil sample. The acquired temperatures and FI/MS data for the 19 component blend were processed on the IBM 370/158 to obtain a quantitative distribution which is in excellent agreement with both the known composition and the one obtained from the FI/MS data acquired using the batch-inlet system for sample introduction. Development of algorithms for correlating the acquired temperatures with the acquired FI/MS data using the NOVA 3/12 and for preparing the correlated data for remote job entry to the IBM 370/158 were initiated. DOE

N80-12199# Institute of Gas Technology, Chicago, Ill.
STATUS OF THE PEATGAS PROCESS

D. V. Punwani 1978 30 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978

(Contract EX-76-C-01-2469)

(CONF-781045-3) Avail: NTIS HC A03/MF A01

PDU-scale tests were conducted to determine the effects of initial scale-up from the laboratory-scale equipment. The hydrogasification PDU represents a scale-up of about 250 times the laboratory-scale hydrogasifier. The tests in the laboratory-scale equipment were conducted with hydrogen and/or helium, whereas the tests in the PDU were conducted with hydrogen, steam-hydrogen, and synthesis gas. The PDU test results are in very good agreement with the results obtained in the laboratory-scale equipment. A mathematical model describing the kinetics was developed for the PEATGAS Process. A complete process design has been prepared for a preliminary base case for producing 250 x 10 to the ninth power Btu/day of SNG from the Minnesota peat (containing 50 percent moisture content). The plant thermal efficiency of this process is estimated to be 67 percent.

Process economics for the completed base-case process design as well as several modified designs are evaluated. DOE

N80-12200# Institute of Gas Technology, Chicago, Ill.

HYGAS PROCESS UPDATE

W. G. Bair 1978 20 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978

(Contract EX-76-C-01-2434)

(CONF-781045-4) Avail: NTIS HC A02/MF A01

Nine tests with Illinois No. 6 Seam coal from the Peabody No. 10 mine were completed at 900 and 500 psig with char conversions reaching 90%, and sinter-free gasifier conditions were achieved at both pressure levels. Fines elutriation was studied and a method of identifying fines sources is being developed so that higher percentages of the char fed to the reactor can be gasified. In addition, the steam-oxygen distributor in the steam-oxygen gasifier zone of the reactor was successfully modified to improve the gasifier's ability to achieve high char conversions under sinter-free conditions. All of these activities and the data obtained through them contributed to improving the data base from which a successful commercial/demonstration plant can be designed. DOE

N80-12201# California Univ., Livermore. Lawrence Livermore Lab.

ENVIRONMENTAL ASPECTS OF ALTERNATIVE FUELS UTILIZATION FOR HIGHWAY VEHICLES

C. J. Anderson 25 Oct. 1978 16 p refs Presented at Environ. Control Symp., Washington, D.C., 28 Nov. 1978

(Contract W-7405-eng-48)

(UCRL-81841; CONF-781109-22)

Avail: NTIS

HC A02/MF A01

Non-petroleum-derived transportation fuels being considered are derived from coal, oil shale, and biomass. The resultant synthetic liquid hydrocarbon fuels may or may not be identical to those derived from petroleum; the alcohols and hydrogen are certainly quite different. A number of environmental issues related to the alternative fuels utilization program are described as well as some of the various projects undertaken to resolve these issues. The accomplishments of these programs are emphasized (in some ways some of these fuels may be superior to existing fuels) and needs for further work are identified. DOE

N80-12202# Dynatech Corp., Cambridge, Mass.

COST ANALYSIS OF AQUATIC BIOMASS SYSTEMS

25 Jul. 1978 268 p refs

(Contract EG-77-C-01-4000)

(HCP/ET/4000-78/1) Avail: NTIS HC A12/MF A01

A cost analysis was conducted to provide the U.S. Department of Energy with engineering cost information on which to base decisions in the area of planning and executing research and development programs dealing with aquatic biomass as an alternative energy resource. Calculations show that several hundred 100 square mile aquatic biomass farms, the size selected for this analysis, would be needed to provide meaningful supplies of energy. It was found that the projections of costs for harvested open-ocean biomass, utilizing optimistic assumptions of scientific and engineering design parameters, appear to be above any practical costs to be considered for energy. One of the major limitations is due to the need to provide upwelled sub-surface water containing needed nutrients, for which pumping energy is required. It is concluded that large scale land-based aquatic biomass farms may merit development, but perhaps within a much narrower range than investigated. Aquatic plants which appear to have potential for development as an energy resource are the so-called emerged plants, or angiosperms, including many types of freshwater weeds such as duckweed, Hydrilla, and water hyacinths. DOE

N80-12204# TRW, Inc., Redondo Beach, Calif.

ENVIRONMENTAL ASSESSMENT REPORT: LURGI COAL GASIFICATION SYSTEMS FOR SNG Final Report, May 1978 - Apr. 1979

M. Ghassemi, K. Crawford, and S. Quinlivan May 1979 344 p refs

(Contract EPA-68-02-2635)

(PB-298109/0; EPA-600/7-79-120)

Avail: NTIS

HC A15/MF A01 CSCL 21D

A compilation and analysis of data on the equipment and processes constituting the Lurgi Substitute Natural Gas (SNG) systems, the control/disposal alternatives for a media, the performance and cost of control alternatives, and present and proposed environmental requirements are presented. Data are provided on the characteristics of input materials, products, and waste streams associated with each process. Pollution control alternatives for air emissions, water effluents, solid wastes, and toxic substances in an integrated facility were examined for performance, costs, energy requirements, and ability to comply with current and anticipated environmental standards. GRA

N80-12291# Gutehoffnungshuette Sterkrade A.G. Oberhausen (West Germany).

ELECTRIC POWER GENERATION AND LNG EVAPORATION WITH THE AID OF GAS TURBINES WITHIN A CLOSED-CYCLE PROCESS

D. Weber 1978 19 p refs In GERMAN Presented at Systems Exhibition Energy - Hanover Fair, Hanover, 19 Apr. 1978

(AED-Conf-78-155-010; CONF-7804102-6) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

In the proposed process the working fluid of a gas turbine plant with a closed circuit is cooled to -140 C with LNG before entering the compressor and heated to +720 C before entering the turbine by means of external heat gained by burning natural gas. With a 1 million cubic m/h throughput of LNG in its normal state, 237 MW of electric power can be generated with 53 percent efficiency with this simple circuit, which can be further developed. In a combination of closed gas turbine and diesel generator, almost 289 MW of electric power can be produced per 1 million cubic m/h LNG with an efficiency of 60 percent.

DOE

N80-12300# National Bureau of Standards, Washington, D.C. Electron Devices Div.

MEASUREMENT TECHNIQUES FOR HIGH-POWER SEMI-CONDUCTOR MATERIALS AND DEVICES: Annual Report, 1 Oct. 1977 - 30 Sep. 1978

Frank F. Oettinger Jun. 1979 146 p refs

(Contract EA-77-A-01-6010)

(PB-298574/5; NBSIR-79-1756)

Avail: NTIS

HC A07/MF A01 CSCL 09A

The development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy technologies is described. The major tasks are: (1) to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime controlling or leakage source defects in power grade silicon material and devices; and (2) to develop procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis. GRA

N80-12338# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 1

1979 433 p Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979

(VKI-Lec-Ser-1979-4-Vol-1) Avail: NTIS HC A19/MF A01

The use of porous media in connection with energy storage or exchange is considered. Heat storage and transfer in packed beds, regenerators, moving bed heat exchangers, and natural convection in porous media are among the topics covered. Application to geothermics and solar energy is emphasized.

N80-12340# Michigan Univ., Ann Arbor. Heat Transfer Lab. **SURVEY AND DESCRIPTION OF TRANSPORT PHENOMENA IN PACKED-BEDS**

John A. Clark /n Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-21 refs

Avail: NTIS HC A19/MF A01

A brief review of the literature pertaining to transport properties in packed beds, particularly as they apply to storage of thermal energy derived from solar energy conversion systems, is presented. Geometric and design parameters that influence the thermal and flow performance of a packed bed are discussed along with analytical models established to simulate the dynamic behavior of the bed. Single and two phase models are included. J.M.S.

N80-12341# Michigan Univ., Ann Arbor. Heat Transfer Lab. **DYNAMIC RESPONSE OF A PACKED-BED ENERGY STORAGE SYSTEM TO A TIME VARYING INLET TEMPERATURE**

/n Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-7 refs

Avail: NTIS HC A19/MF A01

An analytical method for determining the response of a rock-bed energy storage system to temperature variations is outlined. Emphasis is on the case in which the inlet air temperature feeding the bed varies arbitrarily with time, a condition commonly expected in a solar energy supply system. J.M.S.

N80-12342# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

HEAT STORAGE AND THERMAL TRANSFER ASPECTS OF THE DYNAMIC BEHAVIOUR OF A PACKED BED

John A. Clark and Ronald L. Nabozny /n von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-12 refs

Avail: NTIS HC A19/MF A01

The formulation of the dynamic response and thermal storage capacity of a packed bed storage unit for solar energy application is outlined for both the charging and recovery modes. Owing to the limitations of analytical procedures, the solutions to this problem are given in terms of an implicit, finite difference numerical formulation. The computer program for this solution is called ROCKBED. Comparison between the numerical results and those from experiment indicate the importance of improved knowledge of certain empirical data for pack beds, including heat transfer coefficients, effective particle size, void fraction, and wetted area per unit volume. J.M.S.

N80-12346# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 2

1979 402 p refs Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979

(VKI-Lec-Ser-1979-4-Vol-2) Avail: NTIS HC A18/MF A01

Topics are presented on heat exchangers, heat exchange processes, the post accident heat removal from a liquid metal fast breeder reactor, the influence of an obstruction on a fluid particle heat transfer, a fluorescence method for the local voidage in random packed beds, and the application of packed beds to energy storage use of latent heat of fusion.

N80-12353# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

APPLICATION OF PACKED BEDS TO ENERGY STORAGE USE OF LATENT HEAT OF FUSION

J.-M. Buchlin and P. H. Theunissen /n Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 15 p refs

Avail: NTIS HC A18/MF A01

A design of thermal storage unit based on the use of latent heat in packed beds is presented. A theoretical model is described of the unsteady heat transfer in such pile where the particles are formed by heat of fusion material encapsulated in spherical

containers. The temperature distributions of the circulating fluid and of the phase change material as well as the rate of melting are obtained by numerical procedure. The theoretical predictions are validated in comparison with experimental results. M.M.M.

N80-12538* Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.

AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 1

S. C. Rybak 6 Sep. 1978 410 p Sponsored in part by DOE (Contract NAS8-32921) (NASA-CR-161329) Avail: NTIS HC A18/MF A01 CSCL 081

Candidate vertical control systems (VCS) and face advancement systems (FAS) required to satisfactorily automate the longwall system were analyzed and simulated in order to develop an overall longwall system configuration for preliminary design. R.E.S.

N80-12539* Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.

AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: VERTICAL CONTROL SYSTEM (VCS) Final Report

5 Apr. 1979 196 p Sponsored in part by DOE (Contract NAS8-32921) (NASA-CR-161330) Avail: NTIS HC A09/MF A01 CSCL 081

The prototype preliminary design of the vertical control system (VCS) of the 'automated longwall guidance and control system' is presented. R.E.S.

N80-12540* Bendix Corp., Englewood, Colo. **AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: RCS, FAS, AND MCS Final Report**

15 Jun. 1979 315 p Sponsored in part by DOE (Contract NAS8-32921) (NASA-CR-161331) Avail: NTIS HC A14/MF A01 CSCL 081

The prototype preliminary design of the face advancement system (FAS) consisting of the yaw alignment system (YAS) and the roll control system (RCS), and the master control station (MCS) is outlined. R.E.S.

N80-12542* Department of Energy, Washington, D. C. Energy Information Administration.

IDENTIFICATION OF A METHODOLOGY FOR PROJECTING SHORT-TERM CRUDE PETROLEUM PRODUCTION IN THE UNITED STATES

N. D. Uri Dec. 1978 35 p (DOE/EIA-0103/14) Avail: NTIS HC A03/MF A01

Box-Jenkins time series analysis is applied to state level monthly crude petroleum production data to forecast monthly production for 1978. Beyond supplying the requisite forecasts, the model is used to investigate the overall efficacy of the approach. The results indicate that the technique emulates past behavior. Further, for the aggregate United States, production is expected to be 0.65 percent above the level observed in the base period of July 1976 - June 1977 primarily due to a large anticipated growth in California production. DOE

N80-12543* Sandia Labs., Albuquerque, N. Mex. GEO Energy Technology Dept.

OVERVIEW OF IN SITU OIL SHALE TECHNOLOGY AND RECENT ADVANCES IN TRUE IN SITU RETORT MODELING

C. E. Tyner 1979 11 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979 (Contract EY-76-C-04-0789) (SAND-78-2367C; CONF-790803-08) Avail: NTIS HC A02/MF A01

In view of current liquid fuel shortages, development of the oil shale resources of Colorado, Utah, and Wyoming, estimated to contain more than one trillion barrels of oil equivalent, is considered. The in situ processing of this resource offers a

potentially attractive alternative, both economically and environmentally, to surface processing. True and modified in situ retorting technologies are described and current research in these areas briefly outlined. True in situ and related low-void in situ processes would minimize the mining and materials handling problems associated with other technologies. A comprehensive mathematical model developed to describe the retorting process in these beds is presented. Use of the model to investigate the effect of various retort geometries and bed conditions on the oil yield from true in situ and low-void in situ retorts is discussed. DOE

N80-12544* Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.

SHALE OIL: US AND WORLD RESOURCES AND PROSPECTS FOR NEAR-TERM COMMERCIALIZATION IN THE UNITED STATES

G. Marland Mar. 1979 59 p refs (Contract EY-76-C-05-0033) (ORAU/IEA-79-8(R)) Avail: NTIS HC A04/MF A01

Although the United States has large resources of shale oil, several decades of development effort have yet to result in a viable industry. Because both the cost of the oil and the environmental impact of its production are not well known and seem to remain perennially at the margin of acceptability, the matter of commercialization has become a political issue. A variety of economic incentives and government programs to encourage commercial development have been proposed - some implemented - and several industrial corporations are proceeding cautiously. Conflicting political, economic, and environmental views, however, continue to preclude a decisive commitment, and it does not appear at this time that significant quantities of shale oil will be available in the next decade, or probably even longer. DOE

N80-12548 Carnegie-Mellon Univ., Pittsburgh, Pa. **FOAM SOLAR SEA POWER: A PHYSICAL INVESTIGATION Ph.D. Thesis**

Martin Greenstein 1979 151 p Avail: Univ. Microfilms Order No. 7925016

A 30 foot high, 4 in. diameter column of glass pipe was constructed. Apparatus to generate a stable fresh water foam was developed and installed at the bottom of the column. An alcohol drip was found to effectively break foam. This, along with a spray condenser, was installed at the column top. Noncondensable gases were removed from the system by a vacuum pump. Water at 25 C, injected into the bottom of the column, was converted to a foam which flowed towards the 5 C condenser. This flow was found to have a dissipative loss similar to that of laminar flow of liquids in pipes. It was concluded that flow losses should not prevent the successful construction of a scaled-up foam solar sea power plant. Dissert. Abstr.

N80-12550* Committee on Science and Technology (U. S. House).

INVENTORY OF ADVANCED ENERGY TECHNOLOGIES AND ENERGY CONSERVATION RESEARCH AND DEVELOPMENT, 1976-1978, VOLUME 1

Washington GPO 1979 859 p refs Prepared by ORNL and DOE for the Comm. on Sci. and Technol., 96th Congr., 1st Sess., Jan. 1979 (GPO-41-481) Avail: SOD HC

Each of 7,339 research projects is described and listed in one of the following nine sections into which the inventory is divided: solar energy, geothermal energy, hydro energy, basic physical research, biomass production/conversion and alternative fuels, electric power engineering, energy storage, energy conversion, and energy management, policy, and conservation. Each section is organized in a two- and three-level hierarchical arrangement. A.R.H.

N80-12551* Ionics, Inc., Watertown, Mass. Research Div. **ANTON PERMSELECTIVE MEMBRANE**

Samuel S. Alexander, Russell B. Hodgdon, and Warren A. Waite Mar. 1979 52 p Sponsored by NASA

(Contract DEN3-1)

(NASA-CR-159599; DOE/NASA/0001-79/1) Avail: NTIS HC A04/MF A01 CSCL 10A

Experimental composite membranes were synthesized on a lab scale consisting of a thin layer of anion permselective resin supported by and bonded to a porous physically strong and conductive substrate film. These showed good selectivity and also substantially lower electrical resistivities than the homogenous candidate membranes optimized in the previous contract. A wide range of resin porosities were examined for three candidate membrane systems, CDIL, CP4L, and A3L to identify the formulation giving the best overall redox cell performance. Candidate anion membranes showed large increases in resistivity after a short time of immersion in concentrated FeCl/HCl solution. Largely on the basis of resistance stability the CDIL formulation was selected as prime candidate and about thirty-five membranes (one foot square) were produced for experimental static and dynamic evaluation. R.E.S.

N80-12552* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A PHOTOVOLTAIC POWER SYSTEM IN THE REMOTE AFRICAN VILLAGE OF TANGAYE, UPPER VOLTA

William J. Bifano, Anthony F. Ratajczak, and James E. Martz 1979 17 p refs Presented at UNITAR Conf. on Long-Term Energy Resources, Montreal, 26 Nov. - 7 Dec. 1979 Sponsored in part by AID

(NASA-TM-79318; E-274) Avail: NTIS HC A02/MF A01 CSCL 10B

A photovoltaic (PV) system powering a grain mill and a water pump was installed in the remote West African village of Tangaye, Upper Volta. Village characteristics as well as system design, hardware, installation and operation to date are described. The PV system cost is discussed. A baseline socio-economic study performed and a follow-up study is planned to determine the impact of the system on the villagers. R.E.S.

N80-12553* Air Force Academy, Colo. Research Lab.

THE USAF ACADEMY FLYWHEEL-ELECTRIC CAR PRELIMINARY DESIGN REPORT Progress Report, 1 Oct. 1977 - 31 May 1979

David D. Ratcliff May 1979 47 p refs

(AF Proj. 2303)

(AD-A071242; FJSRL-TR-79-0006) Avail: NTIS HC A03/MF A01 CSCL 13/6

Although problems caused by pollution and declining petroleum reserves have caused renewed interest in electric vehicles, currently-available lead-acid batteries impose performance limitations which are unacceptable to most drivers. These limitations, specifically low range and acceleration, are greatly improved by the addition of a flywheel and continuously-variable transmission to the power train of the electric vehicle. This paper describes a low-technology flywheel-electric car built by U.S. Air Force Academy cadets and faculty members in the Department of Physics under funding provided by Frank J. Seiler Research Laboratory. The car design discussed appears to offer the possibility for a four-passenger urban vehicle with a range of 70-100 miles and acceleration performance comparable to that of current sub-compact cars. This performance is achieved with a simple driving system which is comparable to that in current automatic transmission cars. The paper also details the benefits and problems resulting from the low-technology design chosen and provides trade-off analyses on some of the specific problems inherent in the use of a flywheel in the power train of a vehicle. Finally, the paper suggests future improvements which could lower the weight of the vehicle, make the transmission shifting more precise, and improve the performance of the car on grades. GRA

N80-12554* American Univ., Washington, D. C.

ON THE PROPERTIES OF A FUEL CELL ELECTROLYTE Final Report, 10 Jul. 1978 - 15 Jan. 1979

Robert T. Foley Feb. 1979 124 p refs

(Contract DAAK70-78-C-0128)

(AD-A072864) Avail: NTIS HC A06/MF A01 CSCL 10/2

The field of fuel cell electrolytes is surveyed with the objective of learning the deficiencies and good properties of the available systems. The survey included a study of inorganic acids as phosphoric, sulfuric, hydrochloric, perchloric, hydrofluoric and other strong acids; organic acids including sulfonic and carboxylic; alkaline systems; ion exchange membrane systems, solid electrolytes; and molten carbonate systems. Some general and specific conclusions are listed indicating the technical questions to be answered to develop a low temperature organic sulfonic acid system. GRA

N80-12555* Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

PHOTOELECTROCHEMICAL CONVERSION OF OPTICAL ENERGY TO ELECTRICITY AND FUELS Interim Report

Mark S. Wrighton 8 Aug. 1979 37 p refs Submitted for publication

(Contract N00014-78-C-0630; NR Proj. 051-696)

(AD-A072861; TR-2-ONR) Avail: NTIS HC A03/MF A01 CSCL 10/2

Though the first documented photovoltaic effect is associated with a semiconductor/liquid junction, it has not been until very recently that significant solar energy conversion efficiency could be realized with a photoelectrochemical device. A semiconductor/liquid junction solar cell, is one where one or both electrodes in an electrochemical cell is semiconductor such that irradiation of the semiconductor(s) results in the non-spontaneous flow of electric current in the external circuit. Photogeneration of storable chemical fuels in the form of electrolytic products is possible, in addition to the prospect of converting light only to electricity when the redox reaction occurring at one electrode is the reverse of that at the other. The aim of this report is to outline our recent research accomplishments in the field of photoelectrochemistry. Our work in this area began in late 1974 - more than a century after the first studies of photoeffects upon irradiation of an electrode in a cell, and a number of years after modern pioneering studies of semiconductor/liquid interfaces which led to the formulation of our present working hypotheses of such interfaces exposed to optical illumination. GRA

N80-12557* Institute of Gas Technology, Chicago, Ill.

COMMERCIAL APPLICATION OF MOLTEN CARBONATE FUEL CELL SYSTEM

K. F. Blurton and J. R. Peterson 1979 16 p Presented at Energy Technol. Conf. and Exposition, Washington, D.C., 26 Feb. 1979 Prepared in cooperation with Gen. Elec., Schenectady, N. Y.

(Contract EM-78-C-03-1735)

(CONF-790213-4) Avail: NTIS HC A02/MF A01

The potential applications of molten carbonate fuel cells are discussed with particular emphasis on the configuration of a dispersed, oil-fueled and a central, coal-fueled base-load power plant. The penetration of these power plants into the utility generation system is described. The status of this technology is reviewed, and the major technology areas currently under investigation are discussed. DOE

N80-12558* Washington State Univ., Pullman. Environmental Research Center.

COMPARISON OF GEOTHERMAL ENERGY WITH COAL, OIL, AND NATURAL GAS FOR SELECTED USES

G. W. Hinman and J. Robertson 1979 102 p refs

(Contract EY-76-S-06-2221)

(DOE/ET-27139-1; RLO/2221-T14/1) Avail: NTIS HC A06/MF A01

Environmental effects and energy efficiencies for geothermal energy, western strip-mined coal, and eastern underground mined coal applied to space heating, process heat, and electric drive were compared. The measure of an environmental effect is the amount of residual material released to the environment, and the measure of energy efficiency is the second law efficiency of the process involved. The results indicate that geothermal energy efficiencies (second law) are higher than those for coal for all three end uses. The environmental effects for geothermal supply systems are smaller than those for coal in the cases of space heat and process heat and are comparable in the case of electric

drive. The optimum allocation of a finite geothermal resource and a finite coal resource between space heat and drive has been evaluated from the viewpoint of maximum end use service. The results indicate that, to the extent that location factors permit, geothermal energy should be used for space heat and coal for electric drive. DOE

N80-12559# Sandia Labs., Albuquerque, N. Mex.
BATTERIES FOR SPECIFIC SOLAR APPLICATIONS
R. P. Clark 17 Jul. 1979 24 p Presented at DOE/STOR Flow Battery Proj. Rev., Rockville, Md., 17 Jul. 1979 (Contract EY-76-C-04-0789)
(SAND-79-1428C) Avail: NTIS HC A02/MF A01

Reproductions of slides used in an oral presentation are published. Thermal batteries are mentioned, and the program strategy for developing batteries for photovoltaic systems is outlined. DOE

N80-12561# California Univ., Livermore.
USING SURFACE WATERS FOR SUPPLEMENTING INJECTION AT THE SALTON SEA GEOTHERMAL FIELD (SSGF), SOUTHERN CALIFORNIA
E. Raber, Lawrence B. Owen, and Jackson E. Harrar 10 Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979 (Contract W-7405-eng-48)
(UCRL-83011; CONF-790906-15) Avail: NTIS HC A02/MF A01

It was found that direct injection of untreated makeup water is not feasible for cooling because of high suspended solids loading and potential incompatibility problems. However, mixtures of ambient temperature makeup water and higher temperature (80 to 90 C) brine effluent, in a 1:4 mass ratio, are potentially injectable following processing by reaction clarification and granular media filtration. DOE

N80-12562# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 11: NUCLEAR FISSION PROGRAM SUMMARIES
Jun. 1979 345 p
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-11) Avail: NTIS HC A15/MF A01

Brief management and technical summaries of nuclear fission power programs are presented for nineteen countries. The programs include the following: fuel supply, resource recovery, enrichment, fuel fabrication, light water reactors, heavy water reactors, gas cooled reactors, breeder reactors, research and test reactors, spent fuel processing, waste management, and safety and environment. DOE

N80-12563# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
EFFECT OF OPERATING TEMPERATURES ON THE COST OF ENERGY FROM SOLAR THERMAL ELECTRIC POWER PLANTS
L. I. Lukens Jul. 1979 88 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0801) Avail: NTIS HC A05/MF A01

The operating temperature of a solar thermal electric power plant controls the efficiency of the collector field, the efficiency of the power generation system and the cost of the thermal energy storage system. The effect of these three items, as temperature is varied, on the annualized cost of energy produced by the system was evaluated for both stand-alone solar and solar diesel hybrid power plants. The type of solar power plant considered was one using a linear focus distributed collector field and a Rankine cycle power generation system. Systems using different collector performance models, Rankine cycle working fluids and thermal energy storage concepts were included in the evaluation. DOE

N80-12564# Midwest Research Inst., Golden, Colo.
THERMOELECTRIC OCEAN THERMAL ENERGY CONVERSION

T. S. Jayadev, D. K. Benson, and M. S. Bohn Jun. 1979 33 p refs Presented at the Sixth Intern. OTEC Conf., Washington, D.C., 19-22 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-254; CONF-790631-6) Avail: NTIS HC A03/MF A01

A novel thermoelectric ocean thermal energy conversion (OTEC) concept was proposed and compared with the ammonia closed-cycle designs. The thermoelectric OTEC was found to offer several potential advantages including: simpler and more easily mass produced components; higher reliability system performance through the use of a high level of redundancy and long-lived, solid state thermoelectric generators; greater safety for crew and environment by elimination of the pressurized safety for crew and environment by elimination of the pressurized working fluid; and the possibility of lower system costs. DOE

N80-12565# Midwest Research Inst., Golden, Colo.
SYSTEMS ANALYSIS AND TESTING (SAT) PROGRAM Progress Report, 1 Oct. 1978 - 31 Mar. 1979
C. J. Bishop Jul. 1979 19 p refs
(Contract EG-77-C-01-4042)
(SERI/PR-35-313) Avail: NTIS HC A02/MF A01

Activities of the systems analysis and testing (SAT) program are described. These include: (1) a reevaluation of thermosiphon hot water systems; (2) a review of existing wind machine performance models; a study of the effects of wind transients, and control system and load management on energy capture; (3) a study of new concepts for solar ponds involving stratified ponds; (4) establishment of the computational methods center; (5) dissemination of F-chart; (6) a review of photovoltaic systems analysis methods; (7) development of a draft SAT program plan, SAT management plan, and an integrated system test and validation plan, and (8) transfer of technical management of contracts in the SAT program. DOE

N80-12566# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMIZATION OF PHOTOVOLTAIC/THERMAL COLLECTOR HEAT PUMP SYSTEMS
M. C. Russell and E. C. Kern, Jr. 1979 5 p refs Presented at the 1979 Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun. 1979
(Contract EG-77-S-02-4577)
(COO-4577-7; CONF-790541-20) Avail: NTIS HC A02/MF A01

Photovoltaic/thermal (PV/T) collector-heat pump systems were simulated for residences in New York and Fort Worth climates. Analysis of the technical and economic results are discussed. The parallel heat pump configuration with 40 square meters of PV/T collectors was found to be the least-cost system option for the New York residence. DOE

N80-12567# Franklin Inst. Research Labs., Philadelphia, Pa.
THE GREAT ADVENTURE: A REPORT ON THE 10 REGIONAL PUBLIC HEARINGS ON SOLAR ENERGY FOR THE DOMESTIC POLICY REVIEW
Oct. 1978 52 p refs Prepared by the Inst. for Local Self Reliance
(Contract EU-78-C-01-6354)
(HCP/U6354-01) Avail: NTIS HC A04/MF A01

A report on the public hearings is presented along with policy recommendations. The recommendations are as follows: (1) the Federal government should move aggressively from research to commercialization, marketing, and public education; (2) decentralization both in program process and in context should be pursued vigorously; (3) the government should emphasize small scale systems, small businesses, individual inventors, community organizations, and small research groups in its funding programs; (4) solar energy systems that are decentralist are preferred over the more central-oriented; (5) passive solar design was the major technology recommended throughout; (6) DOE must streamline its grants process and reduce paperwork that proposals require; (7) the major item required for a successful solar industry is rapid passage of the solar income tax credit, either within, or separate from, the National Energy Act; (8) low interest loans and investment capital are required by small businesses; (9) public information on solar energy should be more available;

- (10) the budget for solar should be increased substantially; and
 (11) solar programs should be related to job-creation programs.

DOE

N80-12568# Oak Ridge National Lab., Tenn. Engineering Technology Div.

LOW-TEMPERATURE THERMAL ENERGY STORAGE PROGRAM ANNUAL OPERATING PLAN

H. W. Hoffman and D. M. Eissenberg Jan. 1979 130 p
 (Contract W-7405-eng-26)

(ORNL/TM-6605) Avail: NTIS HC A07/MF A01

The LTTES program operating plans for FY 1978 are described in terms of general program objectives and the technical activities being implemented to achieve these objectives. The program structure provides emphasis on seasonal thermal storage, daily/short-term thermal storage, and waste heat recovery and reuse. A work breakdown structure organizes the efforts being carried out in-house or through subcontract within each thrust area. Fiscal data are summarized with respect to thrust area, individual efforts, and funding source.

DOE

N80-12569# California Univ., Livermore. Lawrence Livermore Lab.

HYBRID STAGING OF GEOTHERMAL ENERGY CONVERSION PROCESSES

Robert F. Steidel Sep. 1978 27 p refs

(Contract W-7405-eng-48)

(UCID-17949) Avail: NTIS HC A03/MF A01

A hybrid system consists of two or more energy conversion processes. The use is examined of three energy conversion machines in hybrid systems: the conventional single-phase turbine, and the two-phase expanders known as the Lysholm engine and the radial outflow reaction turbine. Two hybrid systems are presented. The first is a two-stage, single-flash system with the Lysholm engine as the first stage, and a separator and conventional turbine as the second stage. The second system adds a radial outflow reaction turbine to recover a part of the energy rejected in the second stage. A theoretical specific power of 41.3 kW.s/lb is predicted for the two-stage, single-flash hybrid system. The addition of the radial outflow rotary turbine increases performance to 44.8 kW.s/lb. Both are superior to the double-flash system, with a specific power of 37.8 kW.s/lb. In addition, the hybrid system offers operating flexibility.

DOE

N80-12570# California Univ., Livermore. Lawrence Livermore Lab.

NEW CONCEPTS FOR CONVERTING THE ENERGY IN LOW-TO MEDIUM-TEMPERATURE LIQUIDS, WITH EMPHASIS ON GEOTHERMAL APPLICATIONS

Arthur L. Austin and Palmer A. House 20 Sep. 1978 18 p refs

(Contract W-7405-eng-48)

(UCRL-52583) Avail: NTIS HC A02/MF A01

The Geothermal Development Program at Lawrence Livermore Laboratory has produced several novel expanders for liquids of low to medium temperatures (approximately 180 C). A unique radial outflow reaction turbine (RORT) was developed and laboratory-tested; results indicate that 50% engine efficiency is achievable. This work has led to a new concept called the velocity pump reaction turbine (VPRT), which could significantly increase the gross engine efficiency of the RORT, VPRT and its modifications are a unique family of turbines created specifically for expanding liquids to produce shaft work at potential engine efficiencies of up to 70%. Such devices, if used between the two separation stages of a double-flash system, could increase the overall power output by 15 to 20%, reducing power costs by at least 10% for about a 3% increase in capital costs. Geothermal applications are discussed with emphasis on geopressured resources. Also, these machines are suitable for utilizing solar heated fluids and waste heat sources from industrial processes.

DOE

N80-12571# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF SOLAR RANKINE-CYCLE ENGINE SYSTEMS

Gilad Ramback (Ormat Turbines Ltd., Yavne, Israel) Jan. 1979 39 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0986) Avail: NTIS HC A03/MF A01

Electrical parasitic losses are evaluated for two solar Rankine-cycle engine systems: (1) a total-energy solar system for the Midtemperature Solar Systems Test Facility (MSSTF), and (2) the Willard solar irrigation pump. Estimates are given of the minimal electrical parasitic losses that a commercialized total-energy solar system of the size of the MSSTF could have as well as minimal losses for the Willard solar irrigation pump.

DOE

N80-12572# Sandia Labs., Albuquerque, N. Mex. Chemical Technology Div.

CLOSED-CYCLE HYDRIDE ENGINES

Thomas E. Hinkebein, Clyde J. Northrup, and Albert A. Heckes Dec. 1978 25 p refs

(Contract EY-76-C-04-0789)

(SAND-78-2228) Avail: NTIS HC A02/MF A01

Closed cycle hydride engines of 1/2 horsepower or less, which are capable of using a low quality heat source available from flat plate solar collectors or from process waste streams, are described. The engines are simple in concept and operation, potentially inexpensive, reliable, and capable of remote unattended operation. They perform work as hydrogen evolved from a heated metal hydride expands against a flexible member. The cycle is completed by the reabsorption of hydrogen in the metal upon cooling. Theoretical cycles are described and efficiencies are presented. A comparison is made to both Carnot and Rankine cycles.

DOE

N80-12575# Oak Ridge National Lab., Tenn. Energy Div.
WASTE HEAT REJECTION FROM GEOTHERMAL POWER STATIONS

R. C. Robertson Dec. 1978 159 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6533) Avail: NTIS HC A08/MF A01

Waste heat rejection from geothermal power stations is concerned only with the heat rejected from the power cycle. The heat contained in reinjected or otherwise discharged geothermal fluids is not included with the waste heat considered here. The heat contained in the underflow from the flash tanks in such systems is not considered as part of the heat rejected from the power cycle. By following this definition of the waste heat to be rejected, various methods of waste heat dissipation are discussed without regard for the particular arrangement to obtain heat from the geothermal source. Recent conceptual design studies made for 50 MW(e) geothermal power stations at Heber and Niland, California, are of particular interest. The former uses a flashed-steam system and the latter a binary cycle that uses isopentane. In last-quarter 1976 dollars, the total estimated capital costs were about \$750/kW and production costs about 50 mills/kWhr. If wet/dry towers were used to conserve 50% of the water evaporation at Heber, production costs would be about 65 mills/kWhr.

DOE

N80-12576# Ames Lab., Iowa. Solar Div.
OPERATIONAL EXPERIENCE WITH DRAIN-DOWN SOLAR SYSTEMS

P. H. Sidles, R. G. Struss, and E. C. Brohl 1978 11 p ref
 Presented at Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, Colo., 29 Nov. 1978

(Contract W-7405-eng-82)

(IS-M-166; CONF-781102-3) Avail: NTIS HC A02/MF A01

Drain-down solar collector systems offer substantial economic advantage over antifreeze/heat-exchange systems. Drain-down systems are simpler, have lower piping and plumbing costs, and operate at higher collector and system efficiencies. Properly designed and installed drain-down systems intrinsically should require less maintenance. These advantages have not yet been demonstrated in actual operating experience. A substantial number of the Solar Heating and Cooling Demonstration projects under Ames Laboratory cognizance are of drain-down design. Most projects are located in freezing climates; some suffered damage from freezing last winter. Operating experiences for these projects are presented, together with some design criteria for drain-down systems that these operating experiences reveal.

DOE

N80-12577# Los Alamos Scientific Lab., N. Mex.
**PERFORMANCE OF LOS ALAMOS SOLAR MOBILE/
 MODULAR HOME UNIT NO. 1**

J. C. Hedstrom, S. W. Moore, and J. D. Balcomb 1978 7 p
 Presented at Solar Heating and Cooling Systems Operational
 Results Conf., Colorado Springs, Colo., 29 Nov. 1978
 (Contract W-7405-eng-36)
 (LA-UR-78-2587; CONF-781102-1) Avail: NTIS
 HC A02/MF A01

Mobile/Modular Home Unit No. 1 at the Los Alamos
 Scientific Laboratory is an active air system which incorporates
 340 sq ft of flat black single-glazed flat-plate air collectors mounted
 at a 60 tilt on the south wall. The thermal storage is in 1536 pint
 jars of water spaced apart by 5/8 in. to allow air flow around
 the jars. Data have been obtained on the unit from October
 1976, up to the present. Data acquisition is by a Hewlett-Packard
 3050 system controlled with a HP9825 desk top calculator.
 Complete energy summaries for the heating seasons have been
 obtained. The solar energy system has provided about 70% of
 the heating requirements of the house each season. Although
 the solar energy system provides a major fraction of the space
 and domestic hot water requirements, the yearly total energy
 supplied is low. This is primarily because the house load was
 lower than expected due to passive gains and internal heat
 generation. Low performance is also due to a low storage mass
 (5.3 Btu/sq ft F) and several possible uncontrolled air leaks.

DOE

N80-12578# Midwest Research Inst., Golden, Colo.
**DIRECT LABOR REQUIREMENTS FOR SELECT SOLAR
 ENERGY TECHNOLOGIES: A REVIEW AND SYNTHESIS**
 B. Mason and K. Armington Aug. 1978 32 p refs
 (Contract EG-77-C-01-4042)

(SERI/RR-53-045) Avail: NTIS HC A03/MF A01
 Various estimates of the labor requirements for the design,
 manufacture, installation, and maintenance of space heating and
 domestic hot water systems are presented. Total projected job
 requirements by year, calculated by multiplying person-hours
 per system times market penetration estimated, are provided.
 Limitations of previous studies and conclusions about needed
 research are discussed.

DOE

N80-12579# Sandia Labs., Albuquerque, N. Mex. Div. 4715.
**EFFORTS ON THE ECONOMIC ANALYSIS OF DARRIEUS
 VERTICAL AXIS WIND TURBINES**

W. N. Sullivan 1978 8 p ref Presented at Am. Wind Energy
 Assoc. Conf., Hyannis, Mass., 25 Sep. 1978
 (Contract EY-76-C-04-0789)
 (SAND-78-1851C; CONF-780972-1) Avail: NTIS
 HC A02/MF A01

There is an ongoing program designed to establish reason-
 able estimates for the cost of utility grid energy produced by
 Darrieus VAWT systems. The economic analysis is based on the
 detailed examination of actual point designs, which cover a range
 of system sizes. The approach is unique in that in addition to
 determining the direct costs of system components, an effort is
 made to include the indirect costs and profits of the manufacturing,
 marketing, distributions, and sales tasks of the enterprise producing
 the systems. The point design specifications and drawings were
 developed and provide the baseline for this study. The specifica-
 tions represent optimum designs, as determined by an eco-
 nomic optimization model. This model, with mathematical formulas
 for the costs of major system elements, was used to select
 from many possibilities an optimum set of design specifications.

DOE

N80-12580# Oak Ridge National Lab., Tenn. Energy Div.
**FUEL CHOICE AND AGGREGATE ENERGY DEMAND IN
 THE COMMERCIAL SECTOR**

Steve Cohn Dec. 1978 51 p refs
 (Contract W-7405-eng-26)
 (ORNL/CON-27) Avail: NTIS HC A04/MF A01

A fuel choice and aggregate demand model of energy use
 in the commercial sector of the United States is presented. The
 model structure is dynamic with short run fuel price responses
 estimated to be close to those of the residential sector. Of the
 three fuels analyzed, electricity consumption exhibits a greater

response to its own price than either natural gas or fuel oil. In
 addition, electricity price increases have the largest effect on
 end use energy conservation in the commercial sector. An
 improved commercial energy use data base is developed which
 removes the residential portion of electricity and natural gas
 use that traditional energy consumption data sources assign to
 the commercial sector. In addition, household and commercial
 petroleum use is differentiated on a state by state basis. DOE

N80-12582# Department of Energy, Washington, D. C.
 Economic Regulatory Administration.

**STANDBY CONSERVATION PLAN NO. 2: EMERGENCY
 BUILDING TEMPERATURE RESTRICTIONS. AUTHORI-
 TIES: NEED, RATIONALE, OPERATION**

Feb. 1979 29 p
 (DOE/ERA-0048) Avail: NTIS HC A03/MF A01

The text of the Emergency Building Temperature Restric-
 tions is given. The text includes definitions, heating and cooling,
 hot water, reports and recordkeeping, operators, customer lists,
 relation to state law, administrative provisions, public information,
 and penalties. The statement of the need for rationale and
 operation of the plan is also given. The plan applies in each
 state or political subdivision thereof and preempt inconsistent
 state or local law.

DOE

N80-12583# Department of Energy, Washington, D. C. Office
 of Fusion Energy.
**UNITED STATES MAGNETIC FUSION ENERGY PRO-
 GRAM**

S. O. Dean Aug. 1978 176 p
 (DOE/ET-0072) Avail: NTIS HC A09/MF A01

The following topics are discussed: (1) policy; (2) magnetic
 fusion energy program; (3) physics proof-of-principle programs;
 (4) major scaling experiments; (5) energy producing experimental
 reactors: design studies and long lead time technology develop-
 ment; (6) commercialization: reactor designs and systems studies;
 and (7) enhancement studies.

DOE

N80-12585# IBM Federal Systems Div., Huntsville, Ala.
**OCTOBER 1978 ENVIRONMENTAL DATA FOR SITES IN
 THE NATIONAL SOLAR DATA NETWORK**

Oct. 1978 176 p refs
 (Contract EG-77-C-01-4049)
 (SOLAR/0010-78-10) Avail: NTIS HC A09/MF A01

The thermal performance of selected solar energy systems
 was determined. The energy contribution of each solar energy
 system was also determined.

DOE

N80-12586# California Univ., Berkeley. Lawrence Berkeley
 Lab.

**EXPERIMENTAL TEST FACILITY FOR EVALUATION OF
 SOLAR CONTROL STRATEGIES**

M. Majteles, H. Lee, M. Wahlig, and M. Warren 15 Aug. 1978
 11 p Presented at Workshop on the Control of Solar Energy,
 Hyannis, Mass., 23 May 1978
 (Contract W-7405-eng-48)
 (LBL-8308; CONF-7805126-5) Avail: NTIS
 HC A02/MF A01

An experimental solar heating and cooling system was
 constructed. It was designed to serve as a test system to check
 out the operation of a solar controller that looked promising
 in terms of its commercialization potential. Improvements were made
 in the experimental heating and cooling system to enable
 quantitative determination of the auxiliary energy savings made
 possible by using this type of controller. These improvements
 consisted of installation and calibration of accurate instrumenta-
 tion, data acquisition capabilities, and development of simulated
 input and output devices that would allow repeated experi-
 ments using the same running conditions. In addition, the
 possibilities of further development of the heating and cooling
 system into an experimental test facility for a wide range of
 solar control strategies were investigated.

DOE

N80-12588# California Univ., Berkeley. Lawrence Berkeley
 Lab.

RESIDENTIAL ON SITE SOLAR HEATING SYSTEMS. A PROJECT EVALUATION USING THE CAPITAL ASSET PRICING MODEL M.S. Thesis

S. R. Schutz Dec. 1978 60 p refs

(Contract W-7405-eng-48)

(LBL-8298) Avail: NTIS HC A04/MF A01

The feasibility of 'on site solar heating' (OSSH) as a private utility investment was analyzed. The return on OSSH was calculated on the basis of the cost to the consumer of the equivalent amount of electrical energy that is displaced by the OSSH system. The hurdle rate for investment in OSSH was calculated using the Sharpe-Lintner Capital Asset Pricing Model. The results of this study indicate that OSSH is a low risk investment having an appropriate hurdle rate of 7.9%. At this rate, OSSH investment appears marginally acceptable in northern California and unambiguously acceptable in southern California. The results also suggest that utility investment in OSSH should lead to a higher degree of financial leverage for utility companies without a concurrent deterioration in the risk class of utility equity. DOE

N80-12589# California Univ., Berkeley. Lawrence Berkeley Lab.

ANALYSIS OF THE CALIFORNIA SOLAR RESOURCE, VOLUME 2. Final Report

P. Berdahl, D. F. Grether, M. Martin, and M. Wanig Nov. 1978 90 p refs

(Contract W-7405-eng-48)

(LBL-7860-Vol-2) Avail: NTIS HC A05/MF A01

In order to assess the requirements for solar design data, several different paths were followed. The existing literature was consulted, analytical work was carried out within the project to determine the sensitivity of system design to errors in the solar data, and extensive contacts were made with potential users of solar data. Existing solar design techniques were evaluated in order to determine the types and quality of data needed. The determination of future solar data requirements for California was made on the basis of a regionalization of the state into solar zones, a familiarity with existing and proposed high-quality solar data networks, and knowledge of past data collection efforts. Recommendations for action by the state are presented. These recommendations are made to assure that adequate measures are taken now to meet solar data needs of the future. DOE

N80-12590# Sandia Labs., Albuquerque, N. Mex.

SOLAR MECHANICAL ENERGY STORAGE PROJECT

B. C. Caskey and H. M. Dodd 1978 6 p refs Presented at the First Inform. Exchange Conf., Luray, Va., 24 Oct. 1978

(Contract EY-76-C-04-0789)

(SAND-78-1982C; CONF-781046-10)

Avail: NTIS HC A02/MF A01

Systems analyses identified flywheel energy storage systems as the most promising technology for small to intermediate load applications. Detailed design studies to investigate this storage mode are described. DOE

N80-12591# PRC Energy Analysis Co., McLean, Va.

SOLAR ENERGY COMMERCIALIZATION FOR AFRICAN COUNTRIES

Dec. 1978 101 p refs

(Contract EG-77-C-01-2522)

(HCP/CS-2522) Avail: NTIS HC A06/MF A01

Kenya, Cameroon, Nigeria, Niger, Ivory Coast, and Senegal were surveyed as part of the information acquisition task for the DOE International Solar Commercialization Working Group. All these countries are rich in solar energy and are friendly to the U.S. They represent a wide range of geographic features, climatic conditions, and energy resources. The main results are outlined. DOE

N80-12592# Lincoln Lab., Mass. Inst. of Tech., Lexington.

MEAD, NEBRASKA. 25-KW PHOTOVOLTAIC POWER SYSTEM

W. R. Romaine 5 Jan. 1979 43 p refs

(Contract EY-76-C-02-4094)

(COO-4094-10) Avail: NTIS HC A03/MF A01

In 1977 MIT/Lincoln Laboratory designed, constructed, and put into operation a 25 kW peak solar photovoltaic power system in Mead, Nebraska. This system was to be used to provide power to an agricultural test facility operated by the University of Nebraska. The initial application of the PV system was to provide power to irrigate an 80 acre cornfield. The photovoltaic power system is described as it existed at the time of its inauguration, and as it will exist following the completion of presently planned modifications, which include more fully automated control and addition of an uninterruptible power supply. DOE

N80-12593# Drexel Univ., Philadelphia, Pa.

DOUBLE-EXPOSURE COLLECTOR SYSTEM Progress Report, 1 Jul. - 30 Sep. 1978

D. C. Larson and C. W. Savary 31 Oct. 1978 11 p

(Grant EG-77-G-04-4089)

(TID-28964) Avail: NTIS HC A02/MF A01

A retrofit solar water-heating system was installed in a three-story apartment building. The system employs two conventional collector banks (10 PPG collectors) mounted at the latitude angle for Philadelphia of 40 deg from the horizontal and two double-exposure collectors (DEC's) mounted vertically in mirrored enclosures. Although the DEC units are being used for year-round domestic water heating for the building, they are designed to provide maximum output in the winter and are therefore well-suited to solar space heating applications. Instrumentation for testing the collectors was available in the apartment building. New temperature sensors and a heat exchanger were installed and regular data collection was started. Every effort is being made to assure that reliable data are being obtained. A theoretical study of alternative mirror configurations was also completed. These calculations indicate that an optimal adjustable-mirror configuration exists which is optimal at latitudes 35, 40 and 45 deg. One mirror configuration, therefore, can be employed at diverse locations and is adaptable to a variety of solar energy applications. DOE

N80-12594# Institute for Energy Analysis, Oak Ridge, Tenn.

CONSTRAINTS ON ENERGY CONSERVATION

Willem vanGool Sep. 1978 21 p refs

(Contract EY-76-C-05-0033)

(ORAU/IEA-78-17(M)) Avail: NTIS HC A02/MF A01

Energy conservation achieved through technology is discussed and distinguished against energy conservation achieved through changes of lifestyle. In the technological approach, the objectives of energy consuming activities are not questioned; thus, it is accepted that society needs a certain amount of aluminum, polymers, transport, etc., per year. What is analyzed in this approach is how these materials and services can be provided more efficiently. Alternatively, in the change of lifestyle approach to conservation the demand as such is analyzed: do we need aluminum, can we decrease the temperature in homes, do we need to travel? The distinction between the two approaches is demonstrated by considering the rate of energy-consuming activities. R.E.S.

N80-12595# Institute for Energy Analysis, Oak Ridge, Tenn.

FUNDAMENTAL ASPECTS OF ENERGY CONSERVATION POLICY

W. VanGool Nov. 1978 39 p refs

(Contract EY-76-C-05-0033)

(ORAU/IEA-78-20(M)) Avail: NTIS HC A03/MF A01

The 'technological fix' approach to energy conservation is discussed. Higher capital investment can lead to a decrease in direct use of energy. Both the cost and the energy involved in these investments were analyzed along a conservation path, and a limited number of constants were used to direct the changes along this path. It was found that an increase in the price of energy will lead to higher capital investments in accordance with the economic lifecycles in the different sectors. For applications with a short lifetime, such as in the transport sector, energy conservation will mainly take place through the construction of new equipment. In sectors with long-lifetime investments (e.g., buildings), retrofitting will be important. DOE

N80-12596# California Univ., Livermore. Lawrence Livermore Lab.

MECHANICAL ENERGY STORAGE TECHNOLOGY DEVELOPMENT FOR ELECTRIC AND HYBRID VEHICLE APPLICATIONS

T. M. Barlow 17 Oct. 1978 10 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978

(Contract W-7405-eng-48)

(UCRL-81786; CONF-781046-11)

Avail: NTIS

HC A02/MF A01

Flywheel concepts and one elastomeric energy storage concept all applicable to regenerative braking are developed. The performance and fuel economy of electric vehicles are improved. An experimental study of the effect of load leveling on battery life and analytical evaluations of mechanical energy storage technology are included. These activities are integrated in an overall plan and management structure designed to enhance the commercialization of electric vehicles. DOE

N80-12597# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

RESEARCH ON THE DYNAMICS OF BAND-SUPPORTED FLYWHEEL SYSTEMS Final Report

C. W. Bert, C. A. Kocay, T. L. Chen, and J. P. Busby Nov. 1978 61 p refs

(Contract EY-76-C-04-0789)

(SAND-78-7074) Avail: NTIS HC A04/MF A01

Analytical research is reported relating to various aspects of the dynamics of band-supported, composite-material-rim flywheel energy-storage systems for application in hybrid automotive vehicles. A parametric study is carried out for free whirling of a flywheel system with a flywheel shaft supported by ball bearings, typical of a class of configurations contemplated in vehicular application as distinguished from R and D spin tests. It is shown that for a wide range of combinations of hub location and bearing and shaft stiffnesses, it is possible to avoid having any potentially dangerous forward-precession critical speeds throughout the desired operating range of 8,000 to 32,000 rpm. Nonlinear analyses are presented to describe the behavior of the bands in both the translational and tilting modes. The primarily softening behavior is geometrically induced and can lead to buckling at relatively small amplitudes. The band behaviors are approximated by polynomial expansions and applied to analyses of the steady-state forced whirling response. An analysis is presented for the behavior of a ring-type containment system after failure of the bands. This analysis combines Hertzian impact theory with an analysis of ring response to a concentrated load of half-sine waveform. It is shown that a 1-inch thick aramid-epoxy ring should provide satisfactory containment. Small model studies were initiated to study some of the nonlinear and containment phenomena. DOE

N80-12598# Oak Ridge National Lab., Tenn.

CRYSTALLOGRAPHIC CONTRIBUTIONS TO THE ENERGY PROBLEM

M. K. Wilkinson 1978 51 p Presented at 11th Congr. of Crystallography, Warsaw, 2 Aug. 1978

(Contract W-7405-eng-26)

(CONF-780867-1) Avail: NTIS HC A04/MF A01

Areas in which studies of crystallography can contribute to development of new materials for energy technology are reviewed. DOE

N80-12599# Oak Ridge National Lab., Tenn.

REGIONAL ECONOMIC/DEMOGRAPHIC PROJECTIONS FOR ENERGY POLICY ANALYSIS

D. J. Bjornstad Jan. 1979 37 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6668) Avail: NTIS HC A03/MF A01

The importance of adequate population and employment projections for regional policy analysis related to energy, and whether energy policy may significantly modify existing trends is studied. It is concluded that energy is less likely to create new subnational socio-economic tendencies than to enhance or retard existing trends, but that to analyze these circumstances a growth-policy format is desirable. It is emphasized that a lack

of past experience with many new energy technologies will make impact analysis difficult. For this reason, attempts should be made to anticipate possible impacts well in advance of technology deployment. DOE

N80-12600# Gibbs and Cox, Inc., Washington, D. C.

OCEAN THERMAL ENERGY CONVERSION (OTEC) PLATFORM CONFIGURATION AND INTEGRATION, EXECUTIVE SUMMARY Final Report

R. J. Scott Jul. 1978 205 p refs

(Contract EG-77-C-01-4064)

(DOE/ET-4064-1) Avail: NTIS HC A09/MF A01

Studies leading to the development of conceptual designs for two 400 MW Offshore Thermal Energy Conversion (OTEC) commercial plants are summarized. A detailed overview of the study is presented. The successful deployment of a commercial OTEC plant in the near term is dependent upon the optimization of the platform configuration and power plant output level. The optimization procedure is based on both technical and economic factors and is used to evaluate a relatively large number of alternatives, i.e., six hullforms, five plant outputs ranging from 50 to 500 megawatts (MW), and three deployment sites. The hullforms under consideration include the ship (barge), cylinder (disc), spar, submersible, semi-submersible, and sphere; while the deployment sites are Hawaii, New Orleans, and Key West. The second part of the summary describes the development of the two platforms selected by DOE to be carried through the conceptual design level: a 400 MW ship and semi-submersible. DOE

N80-12601# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

ENERGY INFORMATION DATA BASE. SERIAL TITLES, FEBRUARY 1976 - MARCH 1979

Mar. 1979 87 p

(DOE/TIC-4579-R10-Suppl-4) Avail: NTIS HC A05/MF A01

This supplement contains changes and additions to TID-4579-R10 (Serial titles used by the DOE Technical Information Center) and is intended for use with that publication. DOE

N80-12602# Oak Ridge National Lab., Tenn. Computer Sciences Div.

ECONOMICS OF FUSION DRIVEN SYMBIOTIC ENERGY SYSTEMS

J. P. Renier, T. J. Hoffman, and J. G. Martin 1979 7 p refs

Presented at ANS Ann. Meeting, Atlanta, Ga., 3 Jun. 1979 Prepared jointly with Lowell Univ., Mass.

(Contract W-7405-eng-26)

(CONF-790602-50) Avail: NTIS HC A02/MF A01

The economic analysis of symbiotic energy systems in which U233 (to fuel advanced converters burning U233 fuel) is generated in blankets surrounding fusing D-T plasma's depends on factors such as the plasma performance parameters, ore costs, and the relative costs of Fusion Breeders (CTR) to Advanced Fusion Converters. The analysis also depends on detailed information such as initial, final makeup fuel requirements, fuel isotopics, reprocessing and fabrication costs, reprocessing losses (1%) and delays (2 years), the cost of money, and the effect of the underutilization of the factory thermal installation at the beginning of cycle. The results are presented of calculations of overall fuel cycle and power costs, ore requirements, proliferation resistance and possibilities for grid expansion, based on detailed mass and energy flow diagrams and standard US INFCE cost data and introduction constraints, for realistic symbiotic scenarios involving CTR's (used as drivers) and denatured CANDU's (used as U233 burners). The results are compared with those obtained for other strategies involving heterogeneous LMFBR's which burn Pu to produce U233 for U233-burners such as the advanced CANDU converters (MEU233-CANDU). DOE

N80-12603# Little (Arthur D.), Inc., Cambridge, Mass.

SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB) COMMERCIALIZATION REPORT. PART B: ANALYSIS OF MARKET DEVELOPMENT, VOLUME 2 Final Report

Sep. 1977 88 p

(DOE/TIC-10071) Avail: NTIS HC A05/MF A01

The SHACOB Commercialization Model is designed to gauge the impacts of selected Federal incentive programs to encourage the development of solar energy equipment for hot water heating, space heating and space cooling in residential and commercial buildings. The model was implemented as a FORTRAN program and is presently running on the FEA computer system. It is used via the super WYLBUR data management system at FEA. Some modeling results are presented. DOE

N80-12604# Stockholm Univ. (Sweden). Forskningsgruppen for Energisystemstudier.

EFFECTS OF ENERGY POLICY ON INDUSTRY

Alf Carling and Joyce Dargay Jun. 1978 211 p refs In SWEDISH; ENGLISH summary (USFFE-1978-8) Avail: NTIS (US Sales Only) HC A10/MF A01; DOE Depository Libraries

The results from a number of studies of energy consumption in Swedish manufacturing industries and of the sensitivity of different industrial sectors to energy taxation and other kinds of energy policy measures are presented. These studies were concentrated on three energy-intensive sectors, namely the pulp and paper industry; mining and metal production (especially iron mines and the steel industry); and the brick, cement, and lime industry. DOE

N80-12605# Los Alamos Scientific Lab., N. Mex.

PROCESS DESIGN OF THE LASL BISMUTH SULFATE THERMOCHEMICAL HYDROGEN CYCLE

K. E. Cox, J. H. Pendergrass, and W. M. Jones 1979 8 p refs Presented at Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979 (Contract W-7405-eng-36) (LA-UR-79-1256; CONF-790803-25) Avail: NTIS HC A02/MF A01

A process engineering flowsheet for a design of the LASL bismuth sulfate thermochemical cycle is presented. The design is based on laboratory data that indicate a lowered endothermic heat load for a partial decomposition of the solid bismuth sulfate. The results of the flowsheeting analysis yield a thermal efficiency of 50% for the cycle when coupled to a conceptual fusion energy heat source at 1500 K. A parametric analysis shows a slight drop in efficiency as the temperature of the heat source is decreased. The LASL bismuth sulfate thermochemical cycle appears to have potential as a means of producing hydrogen from high temperature heat sources such as fusion, fission, and solar energy; it also appears to be competitive with alternative thermochemical cycles as well as with water electrolysis for hydrogen production. DOE

N80-12606# League of Women Voters, Washington, D. C. **ENERGY CONSERVATION TECHNOLOGY EDUCATION PROGRAM Final Report**

Jan. 1979 106 p refs (Contract EC-77-C-01-2165) (HCP/M2165) Avail: NTIS HC A06/MF A01

A project on teaching the public how to use energy more efficiently in the home is described. The methodology of the project is discussed and the findings and achievements are highlighted. A.W.H.

N80-12607# Ehrenkrantz Group, New York, N. Y.

ARCHITECTURAL CONCERNS IN SOLAR SYSTEM DESIGN AND INSTALLATION

S. Weinstein Mar. 1979 34 p (Contract EG-77-C-01-2522) (SOLAR/0801-79-01) Avail: NTIS HC A03/MF A01

The physical (rather than the mechanical or electrical) aspects involved in the design and installation of solar systems are discussed. The typical physical factors and problems encountered in design are considered. The cost effectiveness of various approaches are analyzed. DOE's specific experience relative to what solar designers nationwide are designing in the installation of solar collectors, array structures, piping and storage equipment, with particular emphasis on cost-effective alternatives is discussed. DOE

N80-12608# Bechtel National, Inc., San Francisco, Calif.

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR POWERED WATER PUMPING FOR REMOTE AREAS Final Report

Jul. 1979 110 p refs (Contract EY-76-C-04-0789) (SAND-79-8187) Avail: NTIS HC A06/MF A01

The technology of solar powered water pumping is reviewed. An overview of the technology and its economics is provided, based on a review and assessment of the open literature. It is shown that pumped water is used most extensively for irrigation, and that new irrigation methods, such as the center pivot system, have significantly increased the water pumping power demand in recent years. The coincidence of the peak irrigation season and peak seasonal insolation makes solar energy a good candidate to supplement or displace depletable energy sources currently used for water pumping. Solar powered water pumping demonstration systems utilizing solar thermal, photovoltaic and wind powered energy conversion are evaluated. The prime movers of these systems either drive the pumps directly or indirectly through electric power generation. A comparative evaluation of these and other proposed solar concepts was conducted and resulted in the selection of a reference system comprised of a number of individual parabolic dish collectors with integral Brayton cycle engines. DOE

N80-12609# Giner, Inc., Waltham, Mass.

STUDY OF CORROSION AND ITS CONTROL IN ALUMINUM SOLAR COLLECTORS Annual Report, 1 Jun. 1977 - 31 Jul. 1978

D. Wong, F. H. Cocks, J. Giner, and P. S. Majahad Aug. 1978 68 p refs (Contract EY-76-C-02-2934) (COO-2934-7) Avail: NTIS HC A04/MF A01

The development of corrosion control methods for aluminum solar collectors using ethylene glycol heat transfer fluids was studied. Corrosion inhibitors and impurity scavengers were tested and evaluated at temperatures up to 160 C under various laboratory conditions. A new corrosion rate measurement technique based on the use of thin foil samples was developed and adopted in this program to provide accelerated results. In addition to the development of corrosion control methods, the acquisition of baseline corrosion data was also extended to the aluminum/propylene glycol combination. Propylene glycol was chosen primarily because of its low toxicity. Aluminum corrosion characteristics were determined in 50, 85 and 100% propylene glycol solutions at temperatures between 25 to 160 C. Corrosion behavior of aluminum in more concentrated ethylene glycol solutions (up to 100%) at higher temperatures (up to 160 C) was also obtained in order to broaden the baseline. DOE

N80-12610# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.

SOLAR-POWERED STEAM GENERATOR HELIOSTAT Final Report

J. G. Cottingham Dec. 1978 143 p refs (Contract EY-76-C-02-0016) (BNL-50974) Avail: NTIS HC A07/MF A01

A small-size central-receiver-type solar energy collecting system delivering commercial grade steam is analyzed and a wind avoidance type heliostat designed, built, and successfully tested. The heliostat design effort is described, including reflecting surface materials and measurements, optic considerations and mirror field arrangements, mechanical analysis and fabrication techniques, and economics and cost effectiveness. Measurements of normal incident solar energy at Upton, N. Y., are reported and a method is proposed for estimating this input parameter for other locations proposed. DOE

N80-12611# Ames Lab., Iowa.

PHOTOTHERMAL CONVERSION SURFACE MEASUREMENTS USING PHOTOACOUSTIC AND PHOTOTHERMAL SPECTROSCOPIES

J. F. McClelland and R. N. Kniseley 1978 31 p refs Presented at Seminar on Testing Solar Energy Mater. and Systems.

Washington, D.C. 22 May 1978

(Contract W-7405-eng-82)

(IS-M-202: CONF-780550-10) Avail: NTIS HC A03/MF A01

Photoacoustic and photothermal spectroscopic techniques have recently been under development in a number of laboratories. When applied to solar materials studies these techniques have the potential of providing a more direct measurement of photothermal conversion efficiency than conventional reflection or transmission measurements. Measurements are made by modulating the intensity of an incident light beam, which causes a temperature oscillation in the irradiated material under study, with the oscillation amplitude proportional to the absorbed and subsequently thermalized light energy. In the photoacoustic method the oscillation amplitude is measured by a transducer which detects an acoustical signal driven by the temperature oscillation. A thermal transducer is used as the detector in the photothermal technique. Spectral or integrated measurements are made using a monochromatic or broadband source with no correction needed for the spectral dependence of a detector since the signal is generated by the interaction of light with the sample rather than with a detector. DOE

N80-12612# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).

PHOTOTHERMAL CONVERSION OF SOLAR ENERGY INTO ELECTRICITY

Jaime A. Moragues 1978 37 p refs Transl. into ENGLISH from unidentified Argentine report

(DOE-TR-159) Avail: NTIS HC A03/MF A01

Brief description of various collectors that can be used for electricity production by solar photothermal conversion are given including solar stills, shallow solar ponds, flat plate collectors, fixed collectors with moderate concentration, cylindrical-parabolic concentrators, fixed concentrators, fixed concentrators with faceted mirror, concentrations with concave rotating multiple mirrors, Fresnel lenses, paraboloidal rotating concentrators, semispherical fixed concentrators, central receiver system with linear focus, and central receiver system with point focus. Thermodynamic cycles, energy transport, energy storage, and economics are also discussed. A review of some of the programs throughout the world in development of solar thermal power conversion is included. DOE

N80-12613# Energy Utilization Systems, Inc., Pittsburgh, Pa. **RESEARCH AND DEVELOPMENT OF A HEAT AND PUMP WATER HEATER, VOLUME 1 Final Report**

R. L. Dunning, F. R. Amthor, and E. J. Doyle Aug. 1978 69 p refs

(Contract W-7405-eng-26)

(ORNL/SUB-7321-1) Avail: NTIS HC A04/MF A01

An electric heat pump water heater with an operating efficiency of 2.5 in average conditions of 70 to 75 F ambient air and 55 to 60 F supply water was designed. Separate heat pump designs are available for new water heaters and for retrofitting of existing ones. The condenser is a dual tube direct immersion type which enters the tank through a special 4-in. hole in the top of new tanks. For retrofit units, the condenser is in the form of a helix and is screwed into the tank through the hole normally used by the lower resistance element. The payback period is dependent on the amount of hot water consumption and the price of electricity. In warm climates, the benefit/cost ratio will be improved by higher efficiency from warmer ambient air and by the value of free air conditioning and dehumidification provided while the unit is operating. In colder climates, the improved efficiency from colder supply water and the higher operating savings from higher kilowatt-hour use because of the cold water tend to offset the effect of the less favorable climate. DOE

N80-12614# Centro de Estudios de la Energia, Madrid (Spain). **PROJECT CESA-1, A 1 MW SOLAR POWER PLANT IN ALMERIA**

Juan Temboury 1978 13 p Presented at Symp. on Solar Thermal Power Stations, Koeln, West Germany, 11 Apr. 1978 (AED-CONF-78-212-011; CONF-7804108-3) Avail: NTIS HC A02/MF A01

A solar energy utilization project to be carried out in Spain is described. The plant, CESA-1, is designed for a power of 1 MW. The technical data are given. The plant will start operation in 1980. DOE

N80-12615# Northeastern Legislative Leaders Energy Research Project, Albany, N. Y.

NATIONAL ENERGY ACT OF 1978: A REGIONAL ASSESSMENT

Peter R. Smith Dec. 1978 23 p

(Grant NSF ISP-75-15817)

(PB-296479/9; NSF/RA-780608)

Avail: NTIS

HC A02/MF A01 CSCL 10A

The detailed requirements of the National Energy Act of 1978 is presented and the specific impacts for each of the requirements on the Northeastern states is discussed. GRA

N80-12619 Iowa State Univ. of Science and Technology, Ames. **A REGIONAL APPROACH TO FORECASTING ELECTRIC ENERGY REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENTS Ph.D. Thesis**

Gerald Ray Hill 1979 253 p

Avail: Univ. Microfilms Order No. 7924484

A series of investigations was performed and a multistate procedure developed for use by states in environmental reviews, in assessing the need for adding generating capacity. The multistate procedure enables states to collectively develop a regional forecast of energy requirements, while maintaining individual decision-making authority. A regional demonstration project was utilized as a means for determining what procedural problems exist in developing multistate capabilities. The demonstration project consisted of three sequential applications of the procedure to utility service areas which operate in the southeast in more than one state. Forecasts of electricity consumption were developed and information compiled on future growth of residential, commercial and industrial sectors, by state and by service area. The procedure was applied to a hypothetical midwest/southeast two-state assessment to evaluate its transferability. Performance standards were identified and acceptance criteria established for the procedure. Dissert. Abstr.

N80-12624# Gulf Universities Research Consortium, Bellaire, Tex.

NATURALLY OCCURRING CARBON DIOXIDE SOURCES IN THE UNITED STATES. A GEOLOGIC APPRAISAL AND ECONOMIC SENSITIVITY STUDY OF DRILLING AND PRODUCING CARBON DIOXIDE FOR USE IN ENHANCED OIL RECOVERY

F. W. Zimmerman and C. W. Perry May 1979 137 p refs

(Contract EX-76-C-01-2025)

(FE-2025-38; GURC-Rept-165)

Avail: NTIS

HC A07/MF A01

Preliminary characterizations of reservoir rock quality and gas composition were performed for central Mississippi, West Virginia, the Delaware-Val Verde Basins of west Texas, and several locations in the Rocky Mountains. Four significant accumulations of carbon dioxide were chosen for in-depth geologic, reservoir, and economic analyses. Anticipated flowing pressure, sustained flow rates, recovery efficiencies, original gas in place, and reserves were determined. Sensitivity studies designed to bracket a possible range of prices were generated, utilizing estimated development and production costs, for each of the four areas. Projections of the potential supply, profitability of drilling and producing, and preliminary analysis of potential demand for naturally occurring carbon dioxide are presented. DOE

N80-12625# California Univ., Livermore. Lawrence Livermore Lab.

NUMERICAL MODELING OF LNG SPILL PHENOMENA

W. J. Hogan, B. R. Bowman, and L. C. Haselman 13 Dec. 1978 18 p refs Presented at the Seminar on LNG Peak Shaving, Washington, D. C. 5 Mar. 1978

(Contract W-7405-eng-48)

(UCRL-82031; CONF-780387-1)

Avail: NTIS

HC A02/MF A01

The phenomena that must be simulated in modeling postulated liquefied natural gas (LNG) spills are complex, and some are

not thoroughly understood. These phenomena include differential boil-off, flameless vapor explosions, vapor dispersion, and various modes of combustion. Our modeling results indicate that differential boil-off will create an ethane-enriched portion of the vapor cloud and that this portion will persist for significant times. Dispersion-model predictions begin to disagree at spill sizes between 50 and 100 cu m. Thus, spill tests are needed for larger spills. Both simple and complex combustion models exist. However, uncertainties in the combustion efficiency, optical thickness of the fireball, and cooling effects make the results of these models difficult to interpret properly. They do show that the addition of as little as 5% ethane to a methane cloud would increase the detonability of the cloud eightfold. The state of numerical modeling for evaluating postulated LNG accidents indicates that the theoretical and experimental efforts must be carried out interactively. DOE

N80-12628# California Univ., Livermore. Lawrence Livermore Lab. Energy and Resources Group.

ENVIRONMENTAL ASPECTS OF ALTERNATIVE ENERGY TECHNOLOGIES FOR CALIFORNIA

J. P. Holdren, G. Morris, and G. Tanenbaum Nov. 1978 167 p refs

(Contract W-7405-eng-48)

(UCRL-15002) Avail: NTIS HC A08/MF A01

The following topics are discussed: (1) cost benefit analysis of energy impacts on biological, geophysical, and social environments; (2) impacts of soft and transition technologies such as solar heat, onsite/central wind systems, waste/farm biomass systems, geothermal heat/electricity, hydroelectric dams, and fluidized bed coal burners; (3) observations on increased efficiency; and (4) needs for further work. DOE

N80-12631# Argonne National Lab., Ill.

COMBINED EFFECTS OF POLYCYCLIC AROMATIC HYDROCARBONS AND SUNLIGHT

H. Utsumi, G. R. Lakas, and M. M. Elkind 1979 15 p refs
Presented at Park City Environ. Health Conf., Utah, 4-7 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790447-4) Avail: NTIS HC A02/MF A01

Chinese hamster V79 cells were made photosensitive by dimethylbenzanthracene (DMBA) if the cells were treated with this PAH before, and not after, light exposure at wavelengths from approximately 290 to 400 nm. Samples of PAH's generated from a bench-scale pressurized fluidized bed coal combustion unit sensitized mammalian cells to sunlight-simulating light, although to a lesser extent than the DMBA. In addition, the photosensitization was shown to be a true photodynamic effect. Since all three factors (PAH's sunlight, and oxygen) necessary for the production of the phototoxic agent(s) would be expected to interact in the environment, the results are of particular concern to human health. Both PAH's and sunlight are known carcinogens and their interaction may result in a potentiation of their carcinogenic activities. In addition, the cytotoxicity produced could conceivably have a tumor promoting effect due to the resultant cellular repopulation. DOE

N80-12637# TRW, Inc., Redondo Beach, Calif.

EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 1: GAS- AND OIL-FIRED RESIDENTIAL HEATING SOURCES Final Report, Sep. 1976 - Mar. 1979

N. F. Surprenant, R. R. Hall, K. T. McGregor, and A. S. Werner May 1979 177 p refs

(Contract EPA-68-02-2197)

(PB-298494/6; EPA-600/7-79-029B)

HC A09/MF A01 CSCL 13B

Emissions from gas- and oil-fired residential heating sources were assessed through a critical examination of existing emissions data, followed by the conduct of a phased measurement program to fill gaps in the emissions data base. Mass emission rates of criteria pollutants, trace elements, and organics, including polycyclic organic matter (POM), were determined. Particulate sulfate, SO₂, and SO₃ emission data were also obtained at the

oil-fired sites. The results of the emissions assessment indicate that residential sources are of potential significance based on multiple source severity factors calculated for an array of houses burning gas or oil. Pollutants for which multiple source severity factors exceed 0.05 are NO_x from gas-fired sources and SO₃, and NO_x, and Ni from oil-fired sources. GRA

N80-12647# California Univ., Berkeley. Lawrence Berkeley Lab.

CIRCUMSOLAR RADIATION DATA FOR CENTRAL RECEIVER SIMULATION

A. Hunt, D. Grether, and M. Wahig Aug. 1978 14 p ref
Presented at ERDA Workshop on Methods for Optical Analysis of Central Receiver Systems, Houston, Tex., 10 Aug. 1978 (Contract W-7405-eng-48)

(LBL-8371; CONF-780885-1) Avail: NTIS HC A02/MF A01

The circumsolar measurement project carried out to provide data to assess the effects of circumsolar radiation on the operation of solar thermal conversion systems using concentrating collectors, especially central receiver systems is described. Four circumsolar telescopes were constructed and are providing detailed intensity vs. angle profiles of the solar and circumsolar region, as well as other solar and climatological data. Emphasis is on reducing the data and making it available to groups analyzing the performance of central receiver systems. In most highly concentrating solar systems, the size of the receiver is determined by the ray bundle originating from the most distant heliostat. If the bundle size is calculated by using the solar disc, it is clear that some fraction of the circumsolar radiation will fall outside the receiver aperture. The results provide the detailed type of input data for central receiver simulation codes that are necessary for determining these losses, optimizing the receiver or field size, and determining the distribution of stray flux due to circumsolar radiation. DOE

N80-12668# Stockholm Univ. (Sweden). Dept. of Meteorology.

GLOBAL ECOLOGY AND MAN

Bert Bolin /in WMO On Climate and Mankind 1979 p 27-50 refs

Avail: NTIS HC A99/MF A01

The influence of man on regional and global processes within the biosphere is examined. Present knowledge on the carbon, nitrogen, sulphur and oxygen cycles is reviewed. An assessment of a possible future increase of atmospheric CO₂ shows a large variation in predicted maximum concentration, depending on which assumption is adopted for CO₂ adsorption by land biota. The response of the terrestrial and marine biota to a changing climate is discussed. Author (ESA)

N80-12677# International Institute for Applied Systems Analysis, Laxenburg (Austria).

ENERGY AND CLIMATE: A REVIEW WITH EMPHASIS ON GLOBAL INTERACTIONS

J. Williams, W. Haefele, and W. Sassini /in WMO On Climate and Mankind 1979 p 267-289 refs

Avail: NTIS HC A99/MF A01

The potential impact of energy systems on climate and the implications of the present state of knowledge on energy policy decision making are discussed. The impact of climate on energy supply and demand is examined. The requirements for climate information necessary to improve the assessment of energy climate interaction are outlined. Author (ESA)

N80-12689# World Meteorological Organization, Geneva (Switzerland).

CLIMATIC VARIABILITY, MARINE RESOURCES AND OFFSHORE DEVELOPMENT

T. F. Gaskell (Oil Ind. Intern. Explor. and Produc. Forum, London) /in its On Climate and Mankind 1979 p 633-651 refs

Avail: NTIS HC A99/MF A01

The activities being carried out in marine resource development are surveyed, including the construction of ports, harbors and other coastal facilities, and ship routing in difficult climate situations. The impact of climatic variation is usually more

important when considering short-term weather forecasts, but extremes of climate and long-term trends are important if catastrophes of gross overdesign are to be avoided. Oil is likely to remain the most important marine resource for the next few decades. Manganese nodules and similar seabed mineral concentrations may be valuable in the future. Author (ESA)

N80-12707# Northrop Services, Inc., Huntsville, Ala.
SOLAR-CLIMATIC STATISTICAL STUDY. SUMMARY REPORT, VOLUME 1

Roger E. Bray Feb. 1979 60 p refs 2 Vol.

(Contract EG-77-C-01-4016)

(HCP/T4016-1) Avail: NTIS HC A04/MF A01

Data at 26 (SOLMET) National Weather Service stations were processed to provide preliminary planning data, in the form of statistical information, for selected daily average solar and wind conditions occurring and persisting for time periods of interest. Empirical probabilities were constructed from the historic solar and wind data to provide a reasonable inference of the chance of similar climatological conditions occurring at any given time. (Diurnal wind power variations were also considered). Data used to obtain the daily average solar and wind power probabilities were combined into monthly averages and are presented. Average monthly, seasonal and annual solar and wind power trends were prepared to provide an overview for identifying areas for further investigation. DOE

N80-12709# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.

WIND TIME SERIES ANALYSES FOR WECS APPLICATIONS

Jack W. Reed Dec. 1978 42 p refs

(Contract EY-76-C-04-0789)

(SAND-77-1701) Avail: NTIS HC A03/MF A01

A methodology for wind power analyses of wind speed time series is described, including computation flow diagrams and a FORTRAN program listing. Examples of results are presented but complete outputs will follow in specialized reports. Primary calculation states are: (1) data homogenization for moved anemometers; (2) extrapolations to selected standardized heights; (3) distribution smoothing for observation bias; (4) power distribution function calculation; (5) turbine speed limit effects analysis; (6) time variability assessment; and (7) analysis of light wind durations. DOE

N80-12710# Midwest Research Inst., Golden, Colo.

WIND RESOURCE ANALYSIS

Donald M. Hardy Dec. 1978 20 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-36-088) Avail: NTIS HC A02/MF A01

Modern atmosphere models of near-surface wind flow and primary data sets were developed from previous studies of national and regional wind resources. Because numerous assumptions are necessary to interpret available data in terms of wind energy potential, conclusions of previous studies differ considerably. The primary data sets and principal features of the models are discussed. DOE

N80-12881*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

RESULTS OF DUCT AREA RATIO CHANGES IN THE NASA LEWIS H2-O2 COMBUSTION MHD EXPERIMENT

J. Marlin Smith 1979 12 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA

(NASA-TM-79308; E-264) Avail: NTIS HC A02/MF A01 CSCL 201

MHD power generation experiments utilizing a cesium-seeded H2-O2 working fluid were carried out using a diverging area Hall duct having an entrance Mach number of 2. The experiments were conducted in a high field strength cryomagnet facility at field strengths up to 5 tesla. The effects of power takeoff location, generator loading B field strength, and electrode breakdown voltage were investigated. The effect of area ratio, multiple loading of the duct, and duct location within the magnetic field are considered. R.C.T.

N80-12882# Argonne National Lab., Ill. Engineering Div.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Final Report, Oct. 1977 - Sep. 1978

M. Petrick, G. Fabris, E. S. Pierson, A. K. Fischer, and C. E. Johnson Apr. 1979 214 p refs

(Contract N00014-78-F-0004)

(AD-A073128; ANL/MHD-79-1)

Avail: NTIS

HC A10/MF A01 CSCL 20/9

The experimental results presented herein satisfy one major goal in demonstrating the technical feasibility of two-phase LMMHD (liquid-metal MHD), i.e., operating an MHD generator at power densities equal to or above that anticipated for practical power systems. Power densities of up to 32 MWe/m(3) and efficiencies higher than 0.6 at high void fractions were attained for a small 20 kWe generator. Slip ratio data, and more extensive pressure distribution and voltage profile data are also given. Barium has been identified as an attractive additive for the generation

N80-12894# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR THE MAGNETOHYDRODYNAMIC GENERATOR CHANNEL CODE, MHDCHN

A. J. Russo Jan. 1979 52 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1260) Avail: NTIS HC A04/MF A01

A two-dimensional steady state MHD generator channel code was developed to solve for the electric current density and potential field in a channel section. It was designed to operate with a companion fluid code, SCF, which supplies thermodynamic and velocity data as input; however, it may also be used independently or made to interact with other fluid codes. The program is currently operational on the CDC 6600-7600 computer system. The equations that are solved and the input and output data that are required for operation of the code are described. DOE

N80-12898# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.

CONCEPTUAL DESIGN OF A DEMONSTRATION TOKAMAK HYBRID REACTOR (DTHR)

J. L. Kelley Dec. 1978 195 p refs

(Contract EG-77-C-02-4544)

(WFPS-TME-107) Avail: NTIS HC A09/MF A01

The flexibility of the fusion hybrid reactor to function as a fuel production facility, power plant, waste disposal burner or combinations of all of these, as well as the reactor's ability to use proliferation resistant fuel cycles, has provided the incentive to assess the feasibility of a near-term demonstration plant. The goals for a Demonstration Tokamak Hybrid Reactor (DTHR) were established and an initial conceptual design was selected. Reactor performance and economics were evaluated and key developmental issues were assessed. The study has shown that a DTHR is feasible in the late 1980's, a significant quantity of fissile fuel could be produced from fertile thorium using present day fission reactor blanket technology, and a large number of commercially prototypical components and systems could be developed and operationally verified. The DTHR concept would not only serve as proof-of-principle for hybrid technology, but could be operated in the ignited mode and provide major advancements for pure fusion technology. DOE

N80-12900# California Univ., Livermore. Lawrence Livermore Lab.

SEARCH FOR FUSION POWER

R. F. Post 12 Oct. 1978 16 p

(Contract W-7405-eng-48)

(UCRL-81890) Avail: NTIS HC A02/MF A01

The basics of fusion power are reviewed. Both inertial confinement and magnetic confinement fusion are discussed. DOE

N80-12955# California Univ., Livermore. Lawrence Livermore Lab.

NATIONAL ENERGY ACT OF 1978: FAR WESTERN PERSPECTIVE. A STUDY FOR THE US DEPARTMENT OF ENERGY, FEDERAL REGION 9

D. Dorn and P. Moulthrop 15 Dec. 1978 77 p
(Contract W-7405-eng-48)

(UCID-17944-Rev-1) Avail: NTIS HC A05/MF A01

Information on the impact of the National Energy Act of 1978 (NEA) on Federal Region 9 was studied. The U.S. energy problem; the National Energy Act of 1978; the expected effects of the NEA on Federal Region 9 as a whole; and the expected impact of the NEA in Arizona, California, Hawaii, and Nevada are discussed. DOE

N80-12957*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BALTIMORE APPLICATIONS PROJECT Annual Progress Report, Jun. 1978 - May 1979

Thomas S. Golden and Philip Yaffee Jun. 1979 16 p refs
(NASA-TM-80577; APR-5) Avail: NTIS HC A02/MF A01 CSCL 05A

An update is presented for the following projects: (1) asphalt pavement recycling; (2) data collection platform/water quality monitoring; (3) digital emergency traffic routing; (4) fire department communications and dispatch system; (5) health department management information system; (6) hazardous materials; (7) coal gasification; and (8) emergency vehicle proximity sensing. A.R.H.

N80-12960# Cambridge Systematics, Inc., Mass.

DEMAND FOR SPECIAL PERFORMANCE VEHICLES, 1975 - 2025

Sep. 1978 107 p refs
(Contract W-7405-eng-48)

(UCRL-13911) Avail: NTIS HC A06/MF A01

Concepts were developed for alternative energy storage and propulsion systems for passenger cars and light trucks. These conceptual designs include battery electric systems, hydrogen powered systems, and the quasi-electric-drive hybrid with a small internal combustion engine (ICE) for range extension. The difference between the cost and performance of the special performance vehicles (SPVs) and ICEs was determined. The vehicle miles travelled by each SPV type were forecasted for 1975, 1985, 2000, and 2025. Market forecasts of SPVs in light truck applications and regional ton mile forecasts for heavy truck use were made for use in energy consumption and flow models. National aggregate forecasts of population, auto ownership, per capita income, vehicle miles travelled, ton miles, and other variables were also made. DOE

N80-12962# Mitre Corp., McLean, Va.

THE STATUS OF ADVANCED PROPULSION SYSTEMS FOR URBAN RAIL VEHICLES Final Report, Oct. 1978 - May 1979

Vilas D. Nene May 1979 227 p refs
(Contract DOT-UT-9002)

(PB-297980/5; MTR-79W0022; UMTA-VA-06-0053-79-1)
Avail: NTIS HC A11/MF A01 CSCL 13F

With the advent of power electronics, more efficient alternate propulsion systems have been developed. These include chopper controls, ac drive with induction motors, systems using onboard energy storage, and ac drive with tabular axle motors. A technology review of advanced traction systems is presented, based on information and data gathered from propulsion equipment suppliers in Europe, Japan, and the United States. The status performance characteristics, significant advantages and disadvantages and the deployment of the hardware in revenue service for all these systems are discussed. GRA

N80-12982# California Univ., Berkeley. Lawrence Berkeley Lab.

MEASUREMENT OF CIRCUMSOLAR RADIATION: STATUS REPORT

D. F. Grether, A. Hunt, D. Evans, and M. Wahig Sep. 1978 4 p refs Presented at the 3d Solar Heating and Cooling R and D Branch Contractors Meeting, Washington, D. C., 24 Sep. 1978

(Contract W-7405-eng-48)

(LBL-8391; CONF-780983-7) Avail: NTIS HC A02/MF A01

Four instruments systems, each of which contains a scanning telescope to make the circumsolar measurements, and includes standard solar and meteorological instruments, were deployed at sites of interest to various DOE programs utilizing concentrating collectors systems. The telescope remain more or less in the same place for a period on the order of a year, so that seasonal variations can be quantified. The data obtained are stored and processed, and the results made available to the various solar concentrating collector projects in a form appropriate to each project. These forms include: (1) sample scans of the telescope for a particular time or for a variety of conditions; (2) variation in solar and circumsolar radiation over the course of a day, month or year; and (3) detailed data suitable for input to computer-based simulations or solar energy conversion systems. DOE

N80-12988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETECTION OF HIGH ENERGY X-RAYS FROM THE GALACTIC CENTER REGION

B. R. Dennis, J. H. Beall, E. P. Cutler, C. J. Crannell, J. G. Dolan, K. J. Frost, and L. E. Orwig Oct. 1979 25 p refs
Submitted for publication

(NASA-TM-80584) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of the galactic center region made with the high energy X-ray detector on OSO-8 are discussed. A strong hard X-ray which was detected during these observations from the vicinity of the galactic center are examined. The counting rate spectrum and the photon number spectrum of the flux are determined. Comparisons with the high energy X-ray fluxes observed from sources in the region by others are discussed. A.W.H.

N80-13267 Kansas Univ., Lawrence.

BIOLOGICAL TRANSFORMATION OF LIGHT ENERGY INTO METHANE USING AN ANAEROBIC FILTER Ph.D. Thesis

Vicente JonguitudFalcon 1979 225 p

Avail: Univ. Microfilms Order No. 7925875

The feasibility of a biological system in converting solar energy into the chemical energy of methane is demonstrated. The proposed system consists of two biological reactors, an algae unit and an anaerobic filter, working together to fix solar energy in the form of algae protoplasm which is then anaerobically digested to produce methane. The algae fixes light energy by synthesizing inorganic materials into new protoplasm. The algae protoplasm is fed to an anaerobic filter where it is metabolized by anaerobic microorganisms producing methane, CO₂, and inorganic end products. These inorganic end products are recycled back to the algae unit where they are reused to form more algae protoplasm. Dissert. Abstr.

N80-13272# Sandia Labs., Albuquerque, N. Mex.

COAL LIQUEFACTION SHORT RESIDENCE TIME PROCESS RESEARCH Quarterly Report, 1 Oct. - 31 Dec. 1978

R. K. Traeger and T. C. Bickel Jul. 1979 27 p refs

(Contract EY-76-C-04-0789)

(SAND-79-1400; QR-1) Avail: NTIS HC A03/MF A01

Preliminary concepts have been identified for residence time measurements and further studies are underway to evaluate performance under reaction conditions. Current concepts include: solid phase residence time-magnetic tracer particles or manganese oxide with neutron activation; and liquid phase residence time-reflectance IR or high speed sampling with an organic tracer, radioactive tracer. Limited viscosity and surface tension measurements have been performed in an effort to predict the reactor flow regime. DOE

N80-13273# Department of Energy, Bartlesville, Okla. Energy Technology Center.

PHYSICAL PROPERTIES OF GASOLINE/ALCOHOL AUTOMOTIVE FUELS

F. W. Cox 1979 14 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28-31 May 1979 (CONF-790520-4) Avail: NTIS HC A02/MF A01

The physical property changes (both beneficial and detrimental) which occur when alcohols are added to gasoline as fuel extenders are considered. The experimental data and discussion of results cover four physical property areas: water tolerance, vapor pressure, distillation characteristics, and octane quality. The alcohols include methanol, ethanol, n-propanol, i-butanol, and synthetic methyl fuel. Several additional alcohols were tested, but only as gasoline/methanol cosolvents. The interdependency among the variables which are responsible for the significant property changes was determined so that, where possible, gasoline/alcohol properties can be estimated from blend composition. Trends are also discussed in terms of the general influences of system variables. DOE

N80-13274# Department of Energy, Bartlesville, Okla. **DRIVING CYCLE COMPARISONS OF ENERGY ECONOMIES AND EMISSIONS FROM AN ALCOHOL AND GASOLINE FUELED VEHICLE**

R. L. Bechtold and B. Pullman (Santa Clara Univ., Calif.) 1979 13 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28 May 1979 (CONF-790520-7) Avail: NTIS HC A02/MF A01

A late-model vehicle was converted to operate using methanol, gasoline, or ethanol as fuel and experimental work was done to obtain energy economy and exhaust emissions data for each of the three fuels. Results are compared at equal equivalence ratios both with and without an oxidation catalyst in the exhaust system. Using a catalyst for emissions control, unburned hydrocarbon emissions were lowest during lean operating conditions and were nearly the same for all three fuels under those conditions. Oxides of nitrogen emissions typically were reduced by over 50 percent in changing from gasoline to methanol or ethanol. Photochemical reactivities were calculated and comparisons were made among the fuels during cold start and FTP weighted tests. Gasoline exhaust was often calculated to have the lowest total reactivity during the FTP, however, methanol exhaust reactivity was lowest for the stoichiometric condition with catalyst. DOE

N80-13275# Department of Energy, Bartlesville, Okla. Energy Technology Center.

THE 50,000 MILE METHANOL/GASOLINE BLEND FLEET STUDY Progress Report

K. R. Stamper 1979 14 p refs Presented at 3d Intern. Alcohol Fuels Technol. Symp., Asilomar, Calif., 28 May 1979 (CONF-790520-6) Avail: NTIS HC A02/MF A01

Seven current production automobiles are being used in a fleet study to obtain operational experience in using 10% methanol/90% gasoline blends as an automotive fuel. Data from chassis dynamometer tests (run according to the 1975-1978 Federal test procedure) show fuel economy and exhaust emissions of carbon monoxide, oxides of nitrogen, unburned fuel, methanol, and aldehydes. For each of the vehicles when operated on the 10% methanol blend, and on unleaded low octane Indolene. An average decrease in volumetric fuel economy (approximately 5%) and a reduction in carbon monoxide emissions were associated with the use of the 10% methanol blend. The most severe driveability problems encountered thus far are related to operating on a phase separated fuel and materials compatibility problems with an elastomer in the air-fuel control hardware of one vehicle. DOE

N80-13277# Brookhaven National Lab., Upton, N. Y. **REGENERATIVE PROCESS FOR DESULFURIZATION OF HIGH TEMPERATURE COMBUSTION AND FUEL GASES Quarterly Progress Report, 1 Jul. - 30 Sep. 1978**

M.-S. Shen and J. M. Chen 1978 72 p refs (Contract EY-76-C-02-0016) (BNL-50944; QPR-10) Avail: NTIS HC A04/MF A01

A rotary kiln reactor was used to study the apparent solid-solid reaction between the sulfated limestone and the fly ash from a fluidized bed combustion. The experimental conditions were within the range for regeneration of the lime-based sorbents for fluidized-bed combustion. The measured SO₂ concentrations were favorably interrelated with a derived mathematical model, with the major operating variables of the reactor, such as solid loading, temperature, gas flow rate, etc. The kinetic parameters of the regeneration reaction, the maximum attainable SO₂ concentrations, and the effect of the molar ratio of C/S on the extent of CaSO₄ conversion to CaO were obtained. Calcium silicate retained its activity when repeatedly cycled between sulfation and regeneration. A kiln reactor process for regenerating sulfated calcium oxide reduces the environmental impact of fluid bed waste disposal and improves natural resource utilization. DOE

N80-13279# Department of Energy, Washington, D. C. **ENVIRONMENTAL ANALYSIS OF SYNTHETIC LIQUID FUELS**

12 Jul. 1979 144 p refs (DOE/EV-0044) Avail: NTIS HC A07/MF A01

There appears to be no absolute environmentally related constraint identified for any of the first-generation surface conversion technologies (shale oil, coal liquefaction, and biomass production of ethanol). Second-generation processes run greater risks of major environmental problems. For in situ processes, the major risk is leaching of hazardous materials into water; for direct liquefaction, concern is potential worker and public exposure to toxic substances. Yet-to-be-defined regulations are perceived by developers as major technology development impediments. These include air quality standards (visibility, short-term nitrogen oxide and new PSD regulations), regulation of hazardous wastes and toxic products, underground injection guidelines, and worker safety regulations. Some risk exists that environmental R and D programs cannot fully satisfy all existing and expected regulatory demands, but these risks should be known by 1985 and it is expected that appropriate control adjustments can be made. DOE

N80-13280# Institute of Gas Technology, Chicago, Ill. **RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Oct. - 31 Dec. 1978**

Dennis A. Duncan Mar. 1979 46 p refs (Contract EX-76-C-01-2307)

(FE-2307-46; QR-3) Avail: NTIS HC A03/MF A01

Work on processing of caking coals was continued, and methods of pretreating caking coals were developed and demonstrated by successful runs in the bench-scale unit. Exploratory work done to evaluate the effects of bentonite clay, iron oxide, and heating rate on the reaction system show that both bentonite clay and iron oxide have beneficial catalytic effects. Depth of carbon conversion was found to be more a function of severity of thermal treatment than heating rate over the range studied. Construction of the process development unit (PDU) continued, and much of the major equipment was received. Contracts were awarded for supplying high-pressure gases to the PDU. Fabrication of the preheater coil was completed, and construction of the preheater furnace is underway. Tests were continued in a low pressure simulator of a PDU combustor section, and for a coaxial construction, ceramic shields in the vicinity of the oxygen injection point do not appear to be necessary. DOE

N80-13281# Institute of Gas Technology, Chicago, Ill. **PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK, PROJECT 61003 Annual Report, 1 May 1977 - 30 Apr. 1978**

Feb. 1979 577 p refs (Contract EX-76-C-01-2286) (FE-2286-32) Avail: NTIS HC A25/MF A01

The calculation of gas phase fugacity in NH₃-H₂S-H₂O and NH₃-CO₂-H₂O systems is described. Vapor-Liquid Equilibrium data on cyclohexane-water and four binary hydrogen-solvent systems have been presented. Data obtained on true densities

of low rank coals and their chars are plotted as a function of hydrogen content (wt %, daf). Results of an investigation of formulas for calculating the heating value of coal from its composition are given. A formula, developed from the available data and having the least standard deviation is also presented. Data on minor and trace elements in coal are reviewed. A table of basic properties of pure components of coal liquids is included. Properties of benzene are presented in both S.I. and British Units. The theory of coal cleaning was discussed. DOE

N80-13283# Mueller Associates, Inc., Baltimore, Md.
STATUS OF ALCOHOL FUELS UTILIZATION TECHNOLOGY FOR STATIONARY GAS TURBINES

Richard L. Rentz and Thomas J. Timbario Apr. 1979 35 p refs

(Contract EX-76-C-01-2098)
 (HCP/M2098-03) Avail: NTIS HC A03/MF A01

Efforts being made to establish the feasibility of alcohols as fuels for stationary gas turbines were reviewed to determine if the status of technology has been defined regarding modification necessary to convert existing stationary gas turbines for operation with alcohol fuels, and to determine if the status of technology has been defined for the design of new stationary gas turbines operating on alcohol fuels. Results are presented in a format which describes the test work performed and characterizes the status of alcohol fuels technology (relative to stationary gas turbines) based on this test work. An overview of various factors that, from a systems viewpoint, would need to be considered if a serious effort were made to utilize alcohols as fuels for stationary gas turbines is included. DOE

N80-13285# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR COAL LIQUEFACTION

E. A. Loyd, B. C. Almuala, A. K. Ingberman, L. M. Joseph, N. Lobe, J. S. Siegel, M. I. Singer, and J. H. Smithson 1979 35 p

(TID-28846) Avail: NTIS HC A03/MF A01

The commercial readiness of coal liquids is evaluated and barriers to be overcome are identified. It is concluded that: (1) coal liquids will address a major segment of the energy economy, petroleum and petroleum derived products; (2) methanol and Fischer-Tropsch processes are technically ready but economically uncompetitive; (3) scale up of direct hydrogenation processes to verify commercial feasibility requires major government funding; (4) federal assistance will probably be required for all first-of-a-kind commercial facilities; and (5) coal liquids will be economically competitive with imported petroleum by late 1980's or early 1990's. DOE

N80-13286# Department of Energy, Washington, D. C.
COMMERCIALIZATION TASK FORCE FOR HIGH Btu GASIFICATION

P. Gallo, Richard Passman, Dave Beecy, Allyn Hemenway, Arthur Ingberman, and John Pulice 1979 38 p

(TID-28849) Avail: NTIS HC A03/MF A01

The commercial readiness of high Btu gasification was investigated. It is found that the principal barriers to the commercialization of high Btu gas are: (1) the availability of capital, and (2) uncertainties regarding the marketability of supplies. Unless these barriers are removed, timely production of high-Btu gas is not likely to occur. A Federal role is recommended that would assist the private sector in capital formation with incentives that spread the financial risk appropriately among project beneficiaries. Of the incentives studied, two appear most effective: rolled-in pricing is seen as an important ingredient, especially in the early years of plant operation because of the high initial cost of gas; Federal loan guarantees are effective in assuring capital availability for the industry. Until loan guarantees become available, regulatory mechanisms provide the only remaining option. DOE

N80-13287# Gulf Research and Development Co., Pittsburgh, Pa.

RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS
Quarterly Report, Sep. 1978 - Nov. 1978

D. C. Succop and F. E. Wynne Dec. 1978 11 p
 (Contracts EX-76-C-01-1800; E(49-18)-1800)
 (FE-1800-33) Avail: NTIS HC A02/MF A01

Planned experiments to establish general ranges over which heater variables should be studied were completed. Unit modification was necessary to allow collection of high viscosity product from the heater outlet. Preliminary results indicate that increasing heater residence times and temperatures reduce the slurry viscosity by thermal cracking. At a low heater pressure of 1,000 psig and 2,000 scf/bbl of H₂, heater slurry temperatures above 950 F resulted in increased viscosity and coking. DOE

N80-13288# Bituminous Coal Research, Inc., Monroeville, Pa.
GAS GENERATOR RESEARCH AND DEVELOPMENT: BI-GAS PROCESS **Monthly Progress Report, Apr. 1979**

May 1979 233 p refs Prepared in cooperation with Phillips Petroleum Co., Homer City, Pa.

(Contract EX-76-C-01-1207)
 (FE-1207-62; MPR-92) Avail: NTIS HC A10/MF A01

A life test of two Ni/Mo catalysts, as well as their predecessors, was completed. The results showed that the sample tested was essentially the same as its predecessor. Generally, the activity of the catalyst was close to that predicted by the life test data. Analytical and computer services continued in support of the overall program. A written description of the fluidized-bed methanation PEDU automated data acquisition and reduction systems was generated and is included. DOE

N80-13289# Texaco, Inc., Montebello, Calif.
GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION **Quarterly Report, Oct. - Dec. 1978**

Allen M. Robin Mar. 1979 13 p
 (Contract EX-76-C-01-2247)

(FE-2247-22) Avail: NTIS HC A02/MF A01

Materials from several coal liquefaction pilot plants were evaluated to determine their suitability as feedstocks for proprietary gasification processes. The chemical composition and physical properties of each material were determined. A preliminary pilot plant test was conducted. The operability of the process on the candidate feedstock was evaluated and estimates of preferred processing conditions, product gas yield and composition were made. R.E.S.

N80-13290# TRW Systems Group, McLean, Va. Energy Systems Planning Div.

METHANE RECOVERY FROM COALBEDS PROJECT. TECHNOLOGY TEST PROJECTS: EVALUATION OF CANDIDATE PROJECTS

Feb. 1979 25 p
 (Contract EW-78-C-21-8089)

(METC-8089-T4) Avail: NTIS HC A02/MF A01

Twelve system test concepts for the recovery of methane from coalbeds and utilization of the gas in one or more applications are presented and evaluated. Four projects are recommended for further design development and analysis. R.E.S.

N80-13291# Gulf Research and Development Co., Pittsburgh, Pa.

RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS
Quarterly Report, Jun. - Aug. 1978

D. C. Succop and F. E. Wynne Sep. 1978 13 p
 (Contracts EX-76-C-01-1800; E(49-18)-1800)
 (FE-1800-30) Avail: NTIS HC A02/MF A01

Experimental results confirmed the predicted product liquid and coke yields for delayed coking or bituminous coal with petroleum vacuum residue. The expected modest synergism for liquid production was accompanied by synergistic improvement

in liquid quality. Synergism was somewhat greater when undried sub-bituminous coal was used, confirming that coal slurries can be charged to delayed cokers and thereby release residual oil for incremental charging to fluid catalytic cracking. These results were used as the basis for a preliminary economic assessment of this medium impact interim process when used in existing petroleum refinery delayed cokers. DOE

N80-13292# Amoco Oil Co., Naperville, Ill. Research and Development Dept.

CATALYST DEVELOPMENT FOR COAL LIQUEFACTION Final Annual Report

R. J. Bertolacini, L. C. Gutberlet, D. K. Kim, and K. K. Robinson
Jun. 1979 179 p refs Sponsored by EPRI
(Research Proj. 408-1)

(EPRI-AF-1084; AR-3) Avail: NTIS HC A09/MF A01

New catalysts for the hydrolquefaction of coal to a clean-burning fuel for power generation were screened. The performance of the new catalysts is discussed along with the performance of various hydrogen donor solvents. Modifications in the product workup procedure are described. The effect of various impregnating aids, such as phosphoric acid, on initial performance was investigated. Numerous catalysts were tested further on the continuous pilot plant to establish how their aging behavior responds to changes in surface properties and catalytic metals. Aged catalysts were also characterized extensively to establish the reasons for deactivation. DOE

N80-13293# Department of Energy, Washington, D. C. Div. of Fossil Fuel Extraction.

UNDERGROUND COAL CONVERSION. PROGRAM DESCRIPTION

Jun. 1979 70 p refs
(DOE/ET-0100) Avail: NTIS HC A04/MF A01

Results of the program presented indicate that, while underground coal gasification (UCC) is technically feasible, it still contains some process unknowns, environmental risks, and economic risks that require R and D. In order to contribute to the national energy goals, a strong DOE program which incorporates maximum industry involvement is planned. Major projects are described in some detail. A strong program of supporting activities is expected to address specific problems identified in the field testing and in order to advance UCC technology. The elimination of the high-risk elements of UCC by resolving those technical, environmental, and economic uncertainties that remain, and to enable industry to assume responsibility for commercialization of the process was considered. DOE

N80-13294# Brookhaven National Lab., Upton, N. Y.
COAL CONVERSION IN FLASH HYDROLYSIS REACTORS

Vi-Duong Dang and M. Steinberg May 1979 57 p refs
Presented at the 87th AIChE Natl. Meeting, Boston, 19 Aug. 1979

(Contract EY-76-C-02-0016)
(BNL-26209; CONF-790822-5) Avail: NTIS HC A04/MF A01

Analytical correlations of the experimental results for the Flash Hydrolysis of coal to gaseous and liquid hydrocarbons are presented. A three step reaction mechanism together with a particle-fluid interaction model is used to describe the system. The application of nonlinear estimation methods produces fair agreement between the experimental results and the postulated model. Explicit kinetic expressions as a function of temperature, pressure and reaction time for the reaction yields are developed. Reaction parameters for fluidized bed, entrained bed and fast fluidized bed designs are derived from the kinetic model. DOE

N80-13295# Oak Ridge National Lab., Tenn.
REVIEW OF SUPPORTING RESEARCH AT OAK RIDGE NATIONAL LABORATORY FOR UNDERGROUND COAL CONVERSION

P. R. Westmoreland and L. S. Dickerson 1979 14 p refs
Presented at the 5th Underground Coal Conversion Symp., Alexandria, Va., 18 Jun. 1979

(Contract W-7405-eng-26)

(CONF-790630-9) Avail: NTIS HC A02/MF A01

Chemical and physical properties of lignite, subbituminous coal, bituminous coal, and overburden were measured. Generally, large, monolithic blocks of sample were dried and pyrolyzed. Thermal data and product yields can be correlated to provide an extrapolation from powder pyrolysis to the pyrolysis steps in underground coal gasification. Significant results include correlation of block pyrolysis data for low-rank coals, interpretation of mechanisms, and comparison between low-rank and bituminous coals; heating tests of overburden cores from the Hoe Creek field gasification site; and measurement of physical properties, particularly thermal diffusivity and thermal conductivity of low-rank coals. Correlations, mechanisms, and property measurements are reviewed, and applications to underground coal gasification are discussed. DOE

N80-13296# Los Alamos Scientific Lab., N. Mex.

SYNFUEL (HYDROGEN) PRODUCTION FROM FUSION POWER

R. A. Krakowski, K. E. Cox, J. H. Pendergrass, and L. A. Pooth
1979 6 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)

(LA-UR-79-1115; CONF-790803-9) Avail: NTIS HC A02/MF A01

A potential use of fusion energy for the production of synthetic fuel (hydrogen) is described. The hybrid-thermochemical bismuth-sulfate cycle was as a vehicle to assess the technological and economic merits of this potential nonelectric application of fusion power. DOE

N80-13297# Los Alamos Scientific Lab., N. Mex.

LIQUID HYDROGEN AS AN AUTOMOTIVE FUEL

W. F. Stewart 1979 17 p refs Presented at the 1979 Cryog. Eng. Conf., Madison, Wis., 21-24 Aug. 1979
(Contract W-7405-eng-36)

(LA-UR-79-621; CONF-790815-2) Avail: NTIS HC A02/MF A01

Hydrogen fuel projects involving six vehicles and six hydrogen liquid container designs are discussed. It is shown that service (refueling) stations and bulk distribution systems can be built using present technology. These can be similar in concept to the present service stations and distribution systems. Vehicle refueling and bulk liquid hydrogen transfer will probably be computer controlled as completely as possible. Liquid hydrogen can begin its entry into the automotive fuel picture as a fuel for fixed base vehicles such as trucks, buses, taxis, etc., and expand into the private sector as its availability increases. DOE

N80-13318# National Engineering Lab., East Kilbride (Scotland). Systems Engineering Div.

ENERGY SAVING IN INJECTION MOLDING

G. Gardiner Jan. 1979 35 p Presented at Rubber and Plastics Res. Assoc. Seminar, 1 Feb. 1978
(NEL-662) Avail: NTIS HC A03/MF A01

Power consumption in an injection molding plant was studied and tests on an injection molding machine during a specific work cycle were made. The results clearly establish the energy losses which are present in many injection molding plants. By converting the plant to hydraulic drives and centralized hydraulic power supply, most of the losses could be eliminated. Supporting results of tests on a converted injection molding machine operating from a single hydraulic power source, simulating a centralized hydraulic power supply are also included. Author (ESA)

N80-13362*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.

HEAT PIPE COOLED POWER MAGNETICS Final Report

M. S. Chester Dec. 1979 176 p Revised
(NASA-CR-159659; TRW-33572-6001-RU-00) Avail: NTIS HC A09/MF A01 CSDL 09A

A high frequency, high power, low specific weight (0.57 kg/kW) transformer developed for space use was re-designed with heat pipe cooling allowing both a reduction in

weight and a lower internal temperature rise. The specific weight of the heat pipe cooled transformer was reduced to 0.4 kg/kW and the highest winding temperature rise was reduced from 40 C to 20 C in spite of 10 watts additional loss. The design loss/weight tradeoff was 18 W/kg. Additionally, allowing the same 40 C winding temperature rise as in the original design, the KVA rating is increased to 4.2 KVA, demonstrating a specific weight of 0.28 kg/kW with the internal loss increased by 50W. This space environment tested heat pipe cooled design performed as well electrically as the original conventional design, thus demonstrating the advantages of heat pipes integrated into a high power, high voltage magnetic. Another heat pipe cooled magnetic, a 3.7 kW, 20A input filter inductor was designed, developed, built, tested, and described. The heat pipe cooled magnetics are designed to be Earth operated in any orientation.

Author

N80-13375# Sandia Labs., Albuquerque, N. Mex.

EFFECTS OF METALLURGICAL MICROSTRUCTURE OF ARMATURES ON COMPRESSED MAGNETIC FIELD GENERATORS

A. E. Binder and T. V. Nordstrom 1979 27 p refs Presented at the 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D.C., 29 May 1979

(Contract EY-76-C-04-0789)

(SAND-79-0890C; CONF-790540-3)

Avail: NTIS

HC A03/MF A01

Methods for improving uniform expansion behavior of compressed magnetic field device armatures were studied. Initial microstructure of the copper tubes was altered in a controlled manner by using different forming techniques and alloying. Results show a 25 to 50 percent improvement in uniform explosive expansion radius for electroformed and spun copper armatures compared to standard armatures machined from drawn tubing. Expansion improvement was correlated with changes in the mechanical texture due to forming. The smoother expansion, however, did not result in a significantly higher electrical efficiency with the armature parameters tested.

DOE

N80-13377# Lincoln Lab., Mass. Inst. of Tech., Lexington.

CLASSIFICATION AND TECHNICAL REVIEW OF dc-ac INVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS

E. E. Landsman 30 Apr. 1979 37 p refs

(Contract EY-76-C-02-4094)

(COO-4094-25) Avail: NTIS HC A03/MF A01

A classification system is presented for stand-alone and utility-interactive dc-to-ac inverters used in photovoltaic systems in the 1-to-100-kVA power range. Additional inverter topologies, noted during the classification process, are introduced. To provide background, generally used dc-to-ac inversion technology is reviewed. Relative merits and liabilities of available power devices are discussed and device protective techniques are reviewed. Maximum power point tracking can enhance system value in utility-interactive no-battery photovoltaic power systems. This general theory is reviewed and an improved implementation is described.

DOE

N80-13412# Oak Ridge National Lab., Tenn. Engineering Tech. Div.

CONDENSATION AND EVAPORATION HEAT TRANSFER WITH LOW-BOILING TEMPERATURE FLUIDS

R. W. Murphy and H. W. Hoffman 1979 4 p Presented at Southeastern Seminar on Thermal Sci., SESTS, Boca Raton, Fla., 10 May 1979

(Contract W-7405-eng-26)

(CONF-790539-1) Avail: NTIS HC A02/MF A01

Heat transfer research related to OTEC and geothermal energy conversion power cycles is reviewed.

DOE

N80-13431# Sandia Labs., Albuquerque, N. Mex.

DEVELOPMENT OF IN SITU MARINE SEISMIC AND GEOTECHNICAL INSTRUMENTATION SYSTEMS

E. W. Reece 1979 18 p refs Presented at DOE Symp. on Enhanced Oil and Gas Recovery and Improved Drillings Technol., Tulsa, Okla., 22 Aug. 1979

(Contract EY-76-C-04-0789)

(SAND-79-0868C; CONF-790805-3)

Avail: NTIS

HC A02/MF A01

A pair of in situ marine geotechnical instrumentation systems, capable of operating unattended for extended periods of time in remote locations, were designed and fabricated, and are currently undergoing testing. The seafloor earthquake measurement system measures the response of marine sediments to strong and moderate seismic activity. The geotechnically instrumented seafloor probe measures the in situ pore pressure in soft marine clays. The two systems have many common characteristics. Both systems consist of two principal subsystems: a seafloor data gathering package and a shipboard command and recording package. The seafloor packages are totally self-contained, and incorporate microprocessor-based electronics which control data collection, processing, and storage. Data collected and stored by the seafloor packages are transmitted on command to the command and recording package by a high-data-rate acoustic telemetry system.

DOE

N80-13480# McAlvery and Associates, Hoboken, N. J.

IMPACT OF FLYWHEEL-TRANSMISSIONS ON AUTOMOBILE PERFORMANCE: A LOGICAL BASIS FOR EVALUATION

R. F. McAlvery, III 9 Apr. 1979 31 p refs

(Contract W-7405-eng-48)

(UCRL-52758) Avail: NTIS HC A03/MF A01

The application of flywheel-transmissions to electric vehicles and to petroleum-fueled automobiles was analytically investigated. Simple algebraic equations were developed that describe an automobile's total (laden) mass and energy economy as a function of mission requirements (i.e., payload, range, and drive-cycle acceleration demand). The equations can be used to evaluate the impact of a flywheel-transmission on an automobile's mass and energy economy.

DOE

N80-13490# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

MODIFIED AEROSPACE RELIABILITY AND QUALITY ASSURANCE METHOD FOR WIND TURBINES

William E. Klein 1980 9 p Proposed for presentation at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980

(NASA-TM-79284; DOE/NASA/20370-79/18; E-211) Avail: NTIS HC A02/MF A01 CSCL 14D

The safety, reliability, and quality assurance (SR&QA) approach developed for the first large wind turbine generator project is described. The SR&QA approach was used to assure that the machine would not be hazardous to the public or operating personnel, would operate unattended on a utility grid, would demonstrate reliable operation and would help establish the quality assurance and maintainability requirements for future wind turbine projects. A modified failure modes and effects analysis during the design phase, minimal hardware inspections during parts fabrication, and three simple documents to control activities during machine construction and operation were presented.

R.C.T.

N80-13582# Department of Energy, Washington, D. C. Office of Basic Energy Sciences.

SUMMARIES OF PHYSICAL RESEARCH IN THE GEOSCIENCES

Aug. 1979 65 p refs

(DOE/ER-0030) Avail: NTIS HC A04/MF A01

The Earth, atmospheric, and solar/terrestrial sciences which relate to the development of energy technology are summarized. The topics covered include: geology, geophysics, and Earth dynamics; geochemistry; energy resource recognition, evaluation, and utilization; hydrologic and marine sciences; and solar-terrestrial/atmospheric interactions.

R.C.T.

N80-13601# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

DEVELOPMENT OF MINING GUIDANCE AND CONTROL SYSTEMS Annual Report, Oct. 1976 - Sep. 1977

May 1979 225 p refs
(Contract DI-BM-H0155092)
(NASA-TM-78226; ALW-11) Avail: NTIS HC A10/MF A01
CSCL 081

New fundamental interface sensor concepts were identified and investigated including tabulation of the physical and performance characteristics of two new interface detector concepts: - natural background radiation and magnetic spin resonance. Studies of guidance and control techniques for the longwall miner identified three basic systems for use in automated/remote controlled longwall mining. The following projects were initiated: system study which will more completely define the longwall guidance and control system design concepts; integration of the various control functions (vertical, yaw, and roll); and hardware technical requirements. R.E.S.

N80-13605# Oak Ridge National Lab., Tenn.
GEOPRESSURE ENERGY RESOURCE EVALUATION
G. Samuels May 1979 76 p refs
(Contract W-7405-eng-26)
(ORNL/PPA-79/2) Avail: NTIS HC A05/MF A01

The geopressed aquifers that extend along the northern Gulf of Mexico are perhaps the largest potential source of geothermal energy and natural gas in the United States. Because of the high cost of completing wells into these formations and their relatively low temperatures (200 to 400 F), the utilization of the geothermal energy will be highly dependent on, and of secondary importance to, the value of the methane. The economics of extracting either the geothermal energy or natural gas from these aquifers does not look promising. The combined requirements of high well flow rates (40,000 bbl/day), long life (20 years), and the necessity for close well spacing to minimize the cost of the collection system may be incompatible with the actual characteristics of the reservoirs. These factors place such stringent requirements on the reservoir size, permeability, and compressibility, or specific storage coefficient, that the number of promising production areas may be severely limited. DOE

N80-13607# Department of Energy, Washington, D. C. Energy Information Administration.
CURRENT U. S. PETROLEUM SITUATION AND SHORT-TERM SUPPLY/DEMAND OUTLOOK
Emil L. Nelson, G. D. Butler, C. Dwyer, and S. Wagner Jun. 1979 50 p
(DOE/EIA-0184/5) Avail: NTIS HC A03/MF A01

Potential U.S. supply shortfalls indicate that U.S. consumption of petroleum products could not rise above the low end of the projected range without driving petroleum inventories down below generally accepted target levels to enter the 1979-1980 winter heating season. Preliminary data indicate that U.S. petroleum demand for the first quarter of 1979 appears to have been between the low and medium levels projected by the demand models. Estimated demand during April and May, when allocation of scarce supply appears to have limited the effective demand, falls below the low of the projected range by some 1/2 million barrels daily. Unless world supply conditions change significantly in the coming months, the analysis indicates that the United States may experience continual limitations on imports requiring effective efforts to limit consumption and make maximum use of alternative fuels. DOE

N80-13617 Pittsburgh Univ., Pa.
THEORETICAL ANALYSIS OF MULTI-CELL, HIGH EFFICIENCY BROAD SPECTRAL SENSITIVITY SOLAR CELLS
Ph.D. Thesis
Richard Joseph McPartland 1978 227 p
Avail: Univ. Microfilms Order No. 7924749

A new scheme for interconnecting cells with different band gaps is described. This scheme allows for epitaxial device fabrication without intervening metallic layers or grids by employing a tunnel junction as an interface between the cells. Using this interface, a two-cell solar cell structure is proposed: $npp+n+pp+$. The $npp+n+$ portion has a wider band gap than the $pp+$ portion of the cell. A theoretical model is developed to be used as a design aid prior to device fabrication, to allow

optimization of the solar cell's design, and to predict conversion efficiencies. The three components of the model are: the $npp+$ low-high junction (L-H junction) homojunction solar cell model; the $n+pp+$ L-H junction heterojunction solar cell model; and the $p+n+$ tunnel junction model. The current-voltage characteristics of the tunnel junction are represented by surface-recombination-velocities (SRVs) at either side of the junction's space-charge-layer. Dissert. Abstr.

N80-13319*# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.

COMPARISON OF CENTRIFUGE AND FREEZING CALORIMETER METHODS FOR MEASURING FREE WATER IN SNOW

R. N. Jones May 1979 44 p refs Sponsored by NASA
(NASA-CR-162504; PB-296321/1; NBSIR-79-1604) Avail: NTIS HC A03/MF A01 CSCL 14B

A comparison of two popular methods, namely, the centrifuge and the freezing calorimeter is presented. Results from measurements over a two-month period in the Colorado mountains in the winter of 1978 indicate serious disagreement between these two methods. Some reasons for the disagreement are presented and verified. This raises some important questions pertaining not only to what the two methods actually measure, but also which methods may be appropriate for particular applications. GRA

N80-13622*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

PEP SOLAR ARRAY DEFINITION STUDY Final Programmatic Report

30 Oct. 1979 82 p refs
(Contract NAS9-15870)
(NASA-CR-160398; TRW-35515-6002-RU-00) Avail: NTIS HC A05/MF A01 CSCL 10A

The power extension package (PEP) is a solar array system that will be used on the space transportation system to augment the power of the Orbiter vehicle and to extend the time the vehicle may stay in orbit. The baseline configuration of the PEP is reviewed. The programmatic aspects of the design covering the development plan, the manufacturing facility plan and the estimated costs and risks are presented. R.E.S.

N80-13623*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

MODIFIED POWER LAW EQUATIONS FOR VERTICAL WIND PROFILES

D. A. Spera and T. R. Richards 1979 13 p refs Presented at the Wind Characteristics and Wind Energy Siting Conf., Portland, Oreg., 19-21 Jun. 1979 Sponsored by DOE, American Meteorological Soc., Pacific Northwest Lab.
(E(49-26)-1059)

(NASA-TM-79275; DOE/NASA/1059-79/4) Avail: NTIS HC A02/MF A01 CSCL 10A

Equations are presented for calculating power law exponents from wind speed and surface roughness data. Results are evaluated by comparison with wind profile data measured at a variety of sites. Author

N80-13624*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

LOW NO(X) HEAVY FUEL COMBUSTOR PROGRAM

Eric Lister (DOE, Germantown, Md.), Richard W. Niedzwiecki, and Lester Nichols [1979] 15 p To be presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(Contract EC-77-A-31-1062)

(NASA-TM-79313; E-269; DOE/NASA/1062-79/3) Avail: NTIS HC A02/MF A01 CSCL 10B

The 'low nitrogen oxides heavy fuel combustor' program is described. Main program objectives are to generate and demonstrate the technology required to develop durable gas

turbine combustors for utility and industrial applications, which are capable of sustained, environmentally acceptable operation with minimally processed petroleum residual fuels. The program will focus on 'dry' reductions of oxides of nitrogen, improved combustor durability, and satisfactory combustion of minimally processed petroleum residual fuels. Other technology advancements sought include: fuel flexibility for operation with petroleum distillates, blends of petroleum distillates and residual fuels, and synfuels (fuel oils derived from coal or shale); acceptable exhaust emissions of carbon monoxide, unburned hydrocarbons, sulfur oxides and smoke; and retrofit capability to existing engines.

R.E.S.

N80-13625# Engelhard Minerals and Chemicals Corp., Edison, N. J. Research and Development Dept.

DESIGN AND DEVELOPMENT OF A 30 WATT SOLID POLYMER ELECTROLYTE FUEL CELL POWER SOURCE FUELED WITH CALCIUM HYDRIDE Final Technical Report

O. Adhart 12 Dec. 1978 26 p

(Contract DAAK70-77-C-0222)

(AD-A071157) Avail: NTIS HC A03/MF A01 CSCL 10/2

In recent years MERDCOM has shown renewed interest in the Solid Polymer Electrolyte Hydrogen-Air Fuel Cell. It focuses on the broad spectrum of applications where power requirements are quite small ranging from fractions of a watt to a few hundred watts. Handling simplicity and versatility are of utmost importance in this power range. The SPE cell is uniquely suited. It is operative at ambient temperatures, is rugged and has excellent life characteristics. Combined with a solid hydrogen source such as calcium hydride or magnesium, high energy densities are attainable. A 24 volt, 30 watt device was developed under the contract consisting of a static SPE stack integrated with a hydrogen generator utilizing cartridge contained calcium hydride. Even in short missions of a few hours energy densities are well in excess of those obtained with secondary batteries.

GRA

N80-13627# Idaho National Engineering Lab., Idaho Falls. **ANALYSIS OF BINARY THERMODYNAMIC CYCLES FOR A MODERATELY LOW-TEMPERATURE GEOTHERMAL RESOURCE**

O. J. Demuth Jul. 1979 105 p refs

(Contract EY-76-C-07-1570)

(TREE-1365) Avail: NTIS HC A06/MF A01

Cycles were screened which included isobutane, pentane, cis-2-butene, and several mixed-hydrocarbon working fluids. Dual- and triple-boiling cycles were analyzed. Both shell-and-tube and direct-contact boilers, heaters, and condensers were assessed. A geothermal fluid (geo-fluid), typical of Raft River resource conditions was assumed, which has a temperature of 290 F and 52 parts per million dissolved nitrogen. Special emphasis in the analyses was directed toward investigation of several methods for keeping the loss of working fluid for the cycle at an acceptable level. It was concluded that for the Raft River geo-fluid, the direct-contact cycle has a potential for net geo-fluid utilization effectiveness values, (watt-hr/lbm geo-fluid) equivalent to those of the shell-and-tube cycle. Because of the lower cost of direct-contact components, a potential exists for the direct-contact plant to produce lower cost electrical energy than a comparable shell-and-tube plant.

DOE

N80-13628# General Electric Co., Schenectady, N. Y. Electric Utility Systems Engineering Dept.

REQUIREMENTS ASSESSMENT OF WIND POWER PLANTS IN ELECTRIC UTILITY SYSTEMS. VOLUME 3: APPENDIXES Final Report

W. D. Marsh Jan. 1979 95 p refs Sponsored by Elec. Power Res. Inst.

(EPRI-ER-978-Vol-3) Avail: NTIS HC A05/MF A01

A rational approach to the consideration of wind power plants applied to electric utility systems was developed. Then a requirements assessment and preliminary impact and penetration analyses were performed by studying wind generation in three actual utility systems. Conventional utility loss-of-load probability and production simulation methods were used together with a wind turbine generator performance model developed for the

study. Evaluations were based on comparison of total utility generation system costs with and without wind plants, and were expressed in terms of wind power plant value and cost. (Value is measured by the value of displaced energy and capacity of conventional power plants. Cost consists of the capital, and operating and maintenance costs of the wind plant.) DOE

N80-13629# Argonne National Lab., Ill.

WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 7: NUCLEAR FACILITY PROFILES, AG-CH

Jun. 1979 254 p

(Contract W-31-109-eng-38)

(ANL-PMS-79-2-Vol-7) Avail: NTIS HC A12/MF A01

Capsule summaries of pertinent facts regarding nuclear facilities are presented. The facilities described include the entire fuel cycle from resource recovery to waste management. Power plants and all U.S. facilities are excluded.

DOE

N80-13630# Argonne National Lab., Ill.

WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 8: NUCLEAR FACILITY PROFILES, CO-HU

Jun. 1979 234 p refs

(Contract W-31-109-eng-38)

(ANL-PMS-79-2-Vol-8) Avail: NTIS HC A11/MF A01

Pertinent facts regarding nuclear facilities are summarized. The entire fuel cycle from resource recovery through waste management is covered. The profiles are ordered by country name, and then by facility code.

DOE

N80-13631# Oak Ridge National Lab., Tenn.

LOW-TEMPERATURE THERMAL ENERGY STORAGE PROGRAM ANNUAL OPERATING PLAN

D. M. Eissenberg and H. W. Hoffman Aug. 1979 65 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6934) Avail: NTIS HC A04/MF A01

The development of technologies for storing thermal energy as low temperature sensible or latent heat is considered along with cost effective systems for collecting, storing, and discharging low thermal energy, which will have significant national impact on energy conservation in the near- and mid-term. Emphasis is placed on seasonal thermal storage, and recovery and reuse of waste heat. Fiscal data are summarized according to trust area, individual efforts, and funding source.

R.C.T.

N80-13632# Brookhaven National Lab., Upton, N. Y.

HYDROGEN-HALOGEN ENERGY STORAGE SYSTEM

J. McBreen, S. Srinivasan, F. J. Salzano, and A. H. Beaufre Sep. 1978 60 p refs

(Contract EY-76-C-02-0016)

(BNL-50924) Avail: NTIS HC A04/MF A01

Electrochemical investigations, materials studies, and technoeconomic assessment were performed on the electrochemically regenerative hydrogen-chlorine energy storage system. Electrochemical studies confirmed the reversibility of the cell reactions and the possibility of using the same cell in the electrolysis and fuel cell mode. A detailed heat and mass balance analysis was carried out for the H₂/Cl₂ system for one method of reactant storage and two schemes of heat exchange between the hydrochloric acid storage subsystem and the reactant storage subsystems. Nafion membranes in H₂/Cl₂ cell were characterized. From a cost comparison on a 20 MW/200 MWh electrochemically regenerative hydrogen-halogen system it was concluded that the use of either chlorine or bromine or alternative methods of chlorine storage had an insignificant effect on the overall cost of the system. The most cost effective method of hydrogen storage is very dependent on the cost activated metal hydrides.

DOE

N80-13633# Planco, Inc., Dallas, Tex.

SURVEY OF THE RESEARCH INTO ENERGY-ECONOMY INTERACTIONS. VOLUME 1: SURVEY

R. Coates, D. Hanson, S. Juenger, and J. Kennington Apr. 1979 248 p refs

(Contract EI-78-C-01-6346)

(HCP/16346-01-1-Vol-1) Avail: NTIS HC A11/MF A01

A detailed and comprehensive review of recent (1960 to present) and on-going research into energy-economy interactions

is presented. The results form theoretical and empirical analyses of energy-macroeconomics interactions, the different methodologies used, and the conceptual problems in this research are emphasized. The supply of energy, the price of energy, the world price of oil, energy capital requirements, energy R and D, conservation regulations, and stockpiling are among the variables studied. A conceptual framework for analyzing energy-economy models, the general features and methodologies of a large number of models, and the state of the art in modeling energy-economy interactions are included. Six different energy-economy models: Manne's ETA-MACRO and ETA, Hudson-Jorgenson's LITM, PILOT, Wharton Annual Energy, Reister-Edmonds, and Berkeley (Giassey-Benenson) are reviewed. Each review describes the methodology and general features embodied in the model, summarizes the types of energy-economy interactions addressed, and assesses the capabilities of the model. DOE

N80-13634# Los Alamos Scientific Lab., N. Mex.
ENERGY POLICY AND DECISION ANALYSIS: NEW CONCEPTS AND MECHANISMS

E. L. Kaufman and R. W. Vogel Jul. 1979 52 p refs
(Contract W-7405-eng-36)
(LA-7909-MS) Avail: NTIS HC A04/MF A01

Relevant portions of the energy-management problem and a technique wherein objective energy policy analysis can be performed in a short time frame are described. A precept for decision criteria is proposed and a set of fundamental concepts are described that allow quantitative assessment of policy and decision consequences for the total energy system. A decision conferencing is described wherein the technical assessment is combined with the political acumen of experienced decision makers to allow the best public-interest choice to be made. A rationale is also presented for the organizational placement of the analysis function, outside of government or industry. This placement provides a much needed level of credibility, higher than that which presently exists, and reduces bias and equitably balance the needs of the public, government, and industry. DOE

N80-13635# Midwest Research Inst., Golden, Colo.
SOLAR ENERGY PERSPECTIVES FOR PUBLIC POWER

N. H. Woodley Jun. 1979 22 p refs Presented at Am. Public Power Assoc., 1979 Natl. Conf., Seattle, 19 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-300; CONF-790685-1) Avail: NTIS HC A02/MF A01

Perspectives on the utilization of solar energy for electricity production and thermal energy utilization by the public are briefly summarized. Wind energy conversion, biomass conversion, solar thermal, OTEC, photovoltaics, and solar heating and cooling are discussed. DOE

N80-13636# Argonne National Lab., Ill.
ASSESSMENT OF STIRLING ENGINE POTENTIAL IN TOTAL AND INTEGRATED ENERGY SYSTEMS

T. J. Marciniak, J. C. Bratis, A. Davis, and C. Lee Feb. 1979 167 p refs
(Contract W-31-109-eng-38)
(ANL/ES-76) Avail: NTIS HC A08/MF A01

The advantages and disadvantages of large Stirling engines in total, or integrated, energy systems are discussed and the performance and cost characteristics of such engines are analyzed and compared with the main competitors (diesel engines and gas turbines) for such applications. The comparisons are made through simplified and detailed systems analyses. The requirements for the development of a large Stirling engine are outlined along with a suggested developmental program based on the systems studied and intercomparisons of competing technologies. Results indicate that, given the attributes of the competing technologies involved, the main advantage of the Stirling engine lies in its ability to use fuels other than distillates. This attribute must be developed further in order to provide energy technologies which can burn abundant fuels such as coal or coal-derived fuels. The potentially high efficiency of Stirlings would be especially advantageous in applications where a high electrical-to-thermal energy demand ratio exists. DOE

N80-13637# Department of Energy, Washington, D. C. Div. of Electric Energy Systems.

SYSTEMS ENGINEERING FOR POWER, PROGRAM REPORT

Jun. 1979 372 p
(DOE/ET-0012/2-Rev) Avail: NTIS HC A16/MF A01

The development of the conceptual tools needed for the planning, engineering, and operation of the electric energy systems of the future is discussed. Three areas of increased complexity in the electric energy field are addressed. They are the increasing degree of interconnection between operating areas, the development of new technologies, and a continual tightening of the constraints within which the electric energy system must operate, including financial, environmental and conservation constraints. Each of these driving forces has implication for system operation (control) and for system design (planning). The subprograms which have thus far been developed for control and planning are defined. DOE

N80-13638# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY SYSTEM IN THE FAR WEST: IMPACTS OF THE NATIONAL ENERGY ACT OF 1978

B. Hammond (California Univ., Berkeley), T. Bradshaw (California Univ., Berkeley), and D. Dorn 6 Apr. 1979 46 p refs
(Contract W-7405-eng-48)

(UCRL-52754) Avail: NTIS HC A03/MF A01

The impact of the National Energy Act of 1978 (NEA) on state energy systems in Federal Region IX (Arizona, California, Hawaii, and Nevada) is discussed. Data on the demographic and economic character of the region are presented along with an overview of the impact of the NEA on each energy industry in the region. The act's impact on interstate linkages and the reliability of energy supplies is also assessed. It is concluded that the NEA will serve to encourage actions already being taken by many of the utilities, but that it will not effect major changes in existing patterns of energy use. DOE

N80-13640# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.

RECENT SPIN TEST OF TWO COMPOSITE WAGON WHEEL FLYWHEELS

A. K. Miller 1979 12 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1669C) Avail: NTIS HC A02/MF A01

The dynamic behavior of two structurally dissimilar flywheels was compared. In one design, the graphite/epoxy rim was attached to the aluminum hub with twenty-four thin Kevlar-49/epoxy spokes, while in the other design eight thicker graphite/epoxy spokes connected the rim to the hub. Horizontal disturbances of the flywheel hub were detected for speeds less than approximately 6,000 rpm. These disturbances are believed to be associated with predicted modes of vibration for the flywheel-spin-turbine system. No modes of vibration were sensed for the predicted possible whirl and torsional resonances in the speed range between 6,000 rpm and 22,000 rpm. A squeeze film damper assembly successfully stabilized the flywheel-spin-turbine system when the damper functioned properly; however, low frequency retrograde instabilities were induced into the system by the damper assembly when it was not operated within prescribed parameters. DOE

N80-13642# Sandia Labs., Albuquerque, N. Mex.
SOLAR THERMAL TEST FACILITY HELIOSTAT DEVELOPMENT

D. E. Arvizu Jun. 1979 57 p refs Presented at Intern. Symp. on Concentrating Solar Collector Technol., Albuquerque, N. Mex., 14 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1177; CONF-7806153-1) Avail: NTIS HC A04/MF A01

The STTF heliostat system is described, and performance data are discussed. The STTF, which uses an array of 222 heliostats in a north field configuration, is capable of supplying 5 MWth. energy onto a target on the tower. DOE

N80-13643# California Univ., San Diego.

NATIONAL ENERGY POLICY AND STATE COASTAL PROGRAMS: A CRITIQUE OF CURRENT EFFORTS TO BALANCE ENVIRONMENTAL PROTECTION AND ENERGY PRODUCTION ALONG THE COAST

R. Kanouse and J. Sorensen. Apr. 1979 394 p refs
(Contract EY-76-S-03-0034)

(SAN-0034/263-1) Avail: NTIS HC A17/MF A01

Modifications to the Coastal Zone Management Act (CZMA) are proposed. The first four modifications clarify key provisions in the current Act. The latter four modifications focus upon attributes of the energy facility siting regulatory process that are either ignored or inadequately addressed in the current CZMA. These four proposed modifications are designed to minimize the impediments to an effective and efficient siting process that are caused by the inherent complexities of national energy policy and environmental protection programs. Two legislative options for amending the CZMA, both of which incorporate the eight suggested modifications, are proposed. DOE

N80-13644# Boeing Engineering and Construction, Seattle, Wash.

LINEAR CONCENTRATION SOLAR COLLECTOR IN AN AIR SUPPORTED ENCLOSURE. PRELIMINARY DESIGN STUDY Final Report

J. H. Laasko and D. K. Zimmerman. Mar. 1979 96 p refs
(Contract EY-76-C-04-0789)

(SAND-78-7022) Avail: NTIS HC A05/MF A01

A preliminary design for a low cost linear parabolic concentrating solar collector in a pneumatically stabilized cylindrical plastic film enclosure is described. The collector configuration structural analyses, thermal performance modeling, mass-produced component costs, field assembly methods and maintenance requirements are discussed. Daily efficiencies in excess of 45% are predicted with estimated installed field collector costs of \$90/sq m (\$8.34/sq ft). Results of cost and performance studies indicate that the collector has potential for low cost and offers attractive cost/performance figures-of-merit with further development. DOE

N80-13645# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE TESTING OF THE GENERAL ELECTRIC ENGINEERING PROTOTYPE COLLECTOR

V. E. Dudley and V. E. Workhoven. Jul. 1979 35 p refs
(Contract EY-76-C-04-0789)

(SAND-79-0514) Avail: NTIS HC A03/MF A01

The performance of a 5 meter parabolic dish solar concentrator was characterized. Thermal efficiency and thermal losses were investigated at temperatures from 100 C to 300 C. Significant improvements were made in the performance of the collector during the test cycle. Final efficiency performance ranged from about 60% at 100 C to about 53% at 300 C. Thermal losses varied significantly with changes in wind velocity. R.E.S.

N80-13646# United Technologies Corp., South Windsor, Conn. Power Systems Div.

INTEGRAL CELL SCALE-UP AND PERFORMANCE VERIFICATION Final Report

L. M. Handley, W. E. Houghby, W. H. Johnson, T. G. Schiller, and H. Y. Stryker. Jun. 1979 57 p ref Sponsored by Elec. Power Res. Inst.

(EPRI-EM-1134) Avail: NTIS HC A04/MF A01

The integral cell configuration of the 4.8-MW demonstrator cell size was scaled and the full size packages were tested in short cell stacks to verify the acid management capability and document performance. Low cost cell stack construction techniques were refined, and materials were modified to produce improved cell stack components. A 1530-hour test of a 20-cell stack demonstrated that the performance of the integral cell configuration was equivalent to that of the 4.8-MW demonstrator configuration, and that increased acid inventories could be accommodated in the electrodes without severe performance penalties. Improvements in acid cell stack technology that would be sufficient to allow a 20 percent reduction in total active cell area relative to the demonstrator were investigated. Improvements to previously developed catalysts, catalyst layers, and application techniques were investigated, and subscale single cell endurance

tests were conducted. A cell stack conceptual design incorporating the integral cell concept was initiated. DOE

N80-13647# California Univ., Livermore. Lawrence Livermore Lab.

TIDAL PRESSURE RESPONSE AS A RESERVOIR ENGINEERING TOOL

J. M. Hanson. Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979
(Contract W-7405-eng-48)

(UCRL-83012; CONF-790906-10)

Avail: NTIS

HC A02/MF A01

Fluid pressure oscillations resulting from tidal strain reflect hydrologic and elastic properties of a reservoir. Precise measurement and interpretation of these pressure fluctuations has the potential of being a useful quantitative reservoir engineering tool. A procedure was developed that quantifies the spectral resolution in terms of an absolute confidence level in both amplitude and phase of the spectral estimate. Analysis of one week of data from a well in the Salton Sea is presented. DOE

N80-13648# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

CHARACTERIZATION OF SOLID-WASTE CONVERSION AND COGENERATION SYSTEMS

Ronald L. Ritschard, Kendall F. Haven, Mark Henriquez, Josh Kay, and William Walzer. 15 Aug. 1978 226 p refs
(Contract W-7405-eng-48)

(LBL-7883) Avail: NTIS HC A11/MF A01

Three basic technologies for recovering energy from municipal solid wastes (MSW) are considered: (1) direct combustion using a waterwall incinerator in which heat from burning refuse is converted to steam by circulating water in steel tubes jacketing the interior of the incinerator; (2) manufacture of a relatively uniform shredded, pulverized, or pelleted refuse derived fuel for supplemental firing in a utility boiler; and (3) pyrolysis or destructive distillation of MSW to extract a low Btu fuel gas. End use applications of cogeneration systems include fluidized bed systems for use in the pulp and paper industry; diesel systems using the digested sewage gas of a sewage treatment plant for electricity generation, heating and pumping; and an enhanced oil recovery system. Comparisons are made of Landguard pyrolysis, Garrett flash pyrolysis, Union Carbide Purox process, direct combustion, refuse derived fuels, fluidized bed cogeneration, diesel cogeneration, and enhanced oil recovery. DOE

N80-13649# Midwest Research Inst., Golden, Colo.

REVIEW OF THE ENVIRONMENTAL EFFECTS AND BENEFITS OF SELECTED SOLAR ENERGY TECHNOLOGIES

Kathryn A. Lawrence. May 1979 18 p refs

(Contract EG-77-C-01-4042)

(SERI/TP-53-114R) Avail: NTIS HC A02/MF A01

The environmental effects of photovoltaic cells, wind energy conversion (WEC), and the solar thermal central receiver are reviewed and summarized. The solar energy technologies are assumed to be deployed as centralized energy production facilities. The phase of resource extraction and component production is the most environmentally hazardous. Impacts of plant construction will be somewhat site specific but should approximate impacts associated with any large construction activity. The operation phase is relatively environmentally benign. The WEC operation produces low level noise pollution and presents minimal hazards to flying species. Solar thermal facilities equipped with wet cooling towers may affect local air quality via cooling tower drift. In addition, large installations of each option may alter local microclimate. Decommission of WEC, solar thermal, and photovoltaic facilities should prevent no environmental hazards, although disposal of CdS or GaAs cells will require care. DOE

N80-13650# Brookhaven National Lab., Upton, N. Y.

PROCESS OPTIMIZATION OF INDUSTRIAL ENERGY USE

D. A. Pilati and F. T. Sparrow (Purdue Univ.) 1979 7 p refs
Presented at the Intern. Conf. on Energy Use Management, ICEUM-2, Los Angeles, 22-26 Oct. 1979 Submitted for publication

(Contract EY-76-C-02-0016)
(BNL-26482; CONF-791009-3) Avail: NTIS
HC A02/MF A01

A set of industry-specific process optimization models are developed. These models are to be used for energy use projections, energy policy analyses, and process technology assessments. Applications of the models currently under development show that: (1) system wide energy impacts may be very different from engineering estimates; (2) selected conservation strategies may have the perverse effect of increasing energy use; and (3) a proper combination of energy taxes and investment tax credits is more socially desirable than either policy alone. DOE

**N80-13651# Brookhaven National Lab., Upton, N. Y.
CASE STUDY OF THE BROWNELL LOW ENERGY REQUIRE-
MENT HOUSE**

R. F. Jones, R. F. Krajewski, and G. Dennehy May 1979 78 p
refs

(Contract EY-76-C-02-0016)
(BNL-50968) Avail: NTIS HC A05/MF A01

The design and thermal performance of an innovative house built in 1977 in the Adirondacks area of New York State was evaluated. The house has a very tight and well-insulated envelope, with the rigid insulation board applied to the outside of the frame. Passive solar gain through south-facing glass, along with internal free sources of heat, are shown to provide a substantial part of the building's heating requirements. Effective integral thermal storage, provided by the exposed interior structure, serves to keep interior temperature excursions within acceptable limits. Additional remote storage is provided in the form of a large thermal storage sand bed, with air ducts, located below the basement floor. Calculations and measured performance data show that the house's space heating needs are only about 40 percent of those of a similar size house built to minimum property standards, and less than 25 percent of those of a typical inventory house in the Northeast United States. DOE

**N80-13653# Los Alamos Scientific Lab., N. Mex.
ENERGY PLANNING WITH SOLAR AND CONSERVATIONS:
INDIVIDUAL VALUES AND COMMUNITY CHOICE**

S. A. Noll, F. Roach, and L. Palmiter 1979 6 p refs Presented
at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract W-7405-eng-36)

(LA-UR-79-1599; CONF-790541-24) Avail: NTIS
HC A02/MF A01

Conflict among the priorities of individuals, private sector businesses, and government entities involving the transition to a renewable energy-resource base is considered. These conflicts are intensified by the overwhelming number of externalities created by the actions of each of these decision making groups. An illustrative example of the benefits to be derived from community energy planning is given. It is shown that community energy programs have the potential to stimulate household and community income, create job opportunities, develop a more resilient energy economy, and help mitigate environmental deterioration. DOE

**N80-13654# Brookhaven National Lab., Upton, N. Y.
DESIGN, CONSTRUCTION, AND OPERATION OF THE
SOLAR ASSISTED HEAT PUMP GROUND COUPLED
STORAGE EXPERIMENTS AT BROOKHAVEN NATIONAL
LABORATORY**

P. D. Metz 1979 8 p refs Presented at the 4th Ann. Heat
Pump Technol. Conf., Stillwater, Okla., 9 Apr. 1979

(Contract EY-76-C-02-0016)
(BNL-25908; CONF-790446-3) Avail: NTIS
HC A05/MF A01

The design, construction, and initial operation of the first generation experiments are discussed. Four of these experiments involve buried tanks, and four use buried serpentine coils of 1 1/2 inch diameter flexible polyethylene pipe in various configurations and lengths. Heat is added to or removed from each experiment by hot water heaters or heat pumps. The amount of heat added or removed is determined by a computer program which simulates all parts of the solar system except for the ground coupling device. Experiments conducted to

determine ground thermal conductivity, heat capacity, diffusivity, and moisture content are also discussed. The overall research program plan and some early results are presented. DOE

**N80-13655# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION.
VOLUME 1: SYSTEMS ENGINEERING AND INTEGRATION
Final Report**

7 Jul. 1978 228 p refs
(Contract EG-77-C-01-4065)

(TID-29418) Avail: NTIS HC A11/MF A01

An evaluation methodology was developed for the purpose of analyzing the ocean system requirements against the site criteria and in arriving at the conclusions as far as hull, seawater system, positioning system, and other ocean systems characteristics. Feasibility studies and cold water pipe/hull stress analyses indicated that the best platform hull shape would be one that would have a submerged main body and the cold water pipe would be attached to it in a flexible joint type configuration, possibly with flexible joints along the length as well. The best positioning system would be a static mooring system, possibly 3-leg, using hollow cylindrical links for lines. DOE

**N80-13656# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESPONSE REPORT FOR PACIFIC PLANT
SHIP, 5 TO 10 DEG N 90 TO 95 DEG W**

W. A. Wolff May 1979 44 p refs
(Contract ET-78-C-01-2898)

(HCP/T2898-01/3) Avail: NTIS HC A03/MF A01

The temperature difference resource for the plant ship region between 5 to 10 North latitude and 90 to 95 West longitude is evaluated for potential OTEC use. Surface temperatures are consistently high with the monthly mean temperatures ranging from 26.5 C to 28.5 C. An annual mean delta T greater than 20 C is available at 550 meters. Bottom depths are much greater than 1500 meters for the entire plant ship region. The mixed layer depth is very shallow throughout the year, and may be nonexistent at times indicating a warm water intake near the surface. High winds and storms are not a major problem for this site, due in part to the proximity to the equator. Mean surface currents are somewhat larger in magnitude than other Pacific sites. The site chosen is located near the approximate limits of the North Equatorial Current and the Pacific Equatorial Countercurrent. Current shear may cause problems. DOE

**N80-13658# Department of Energy, Washington, D. C. Energy
Storage Systems Div.**

**MULTI-YEAR PLAN FOR THERMAL AND MECHANICAL
ENERGY STORAGE PROGRAM**

Jun. 1979 79 p refs

(DOE/ET-0109) Avail: NTIS HC A05/MF A01

Reliable, efficient, and inexpensive energy storage technologies to support other DOE end-use divisions in their substitution and energy-savings missions are discussed. In addition to thermal and mechanical technology development, the Technical and Economic Analysis subprogram which supports both the Thermal and Mechanical Storage Program and the Electrochemical (Battery) Storage Program is described. The DOE end-use organizations that benefit from development of thermal and mechanical storage technologies are: Central Solar Technology, Distributed Solar Technology, Solar Applications, Transportation Programs, Buildings and Community Systems, Industrial Energy Conservation, and Resource Applications. DOE

**N80-13660# Aerojet Energy Conservation Co., Sacramento, Calif.
MULTI-USE GEOTHERMAL ENERGY SYSTEM WITH
AUGMENTATION FOR ENHANCED UTILIZATION. NON-
ELECTRIC APPLICATION OF GEOTHERMAL ENERGY IN
SUSANVILLE, CALIFORNIA Final Report**

G. K. Olson, D. L. Benner-Drury, and G. R. Cunningham Feb.
1979 200 p refs

(Contract ET-78-C-03-1740)

(DOE/ET-248447/1) Avail: NTIS HC A09/MF A01

Multi-use, augmented geothermal space/water heating and cooling systems were studied. The overall benefits in both the public and private sectors, of using low temperature (150 F to

240 F) geothermal resources are explored. Options considered, alone and in combination, include heat pumps, fossil-fuel peaking, user load balancing, and cascading from the geothermal system serving the public buildings into a private Park of Commerce development. A range of well temperatures, depths, flow rates, and drilling costs are considered to provide system cost sensitivities. A planned development is emphasized for ease of financing and expansion. A preliminary design of Phase A of a Susanville Public Building Energy System and a conceptual design of an integrated Park of Commerce, Phase 1, are included. This system was designed for a 150 F resource and can be used as a model for other communities with similar resource temperatures. DOE

N80-13661# Research Triangle Inst., Research Triangle Park, N. C.

NOVEL CONCENTRATOR PHOTOVOLTAIC CONVERTER SYSTEM DEVELOPMENT Final Report

S. M. Bedair, M. F. Lamorte, and J. R. Hauser Jul. 1979 207 p refs
(Contract EY-76-C-04-0789)

(SAND-79-7040) Avail: NTIS HC A10/MF A01

The development, synthesis, and evaluation of a cascade solar cell having an AM 1 conversion efficiency of 30 percent or greater and capable of operating at both high illumination levels and elevated temperatures is discussed. A comparison of the cascade solar cells with conventional single junction solar cells is presented. A number of ternary and quaternary material systems which have potential application to the cascade solar cell are discussed. Demonstration cells built in the GaAs/AlGaAs material systems are examined. A.W.H.

N80-13662# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.

SOLAR THERMAL POWER SYSTEMS Annual Technical Progress Report, 1978

Jun. 1979 144 p refs
(DOE/ET-0078/T1) Avail: NTIS HC A07/MF A01

The development of solar thermal power system technology for midtemperature, solar total energy, small community, irrigation, and large power systems is discussed. Subsystem and component development is also described. K.L.

N80-13663# Bureau of Reclamation, Boulder City, Nev.
SOLAR THERMAL ELECTRIC PLANTS IN HYDROELECTRIC GRID Technical Progress Report, 9 Feb. - 9 May 1979

17 Jul. 1979 26 p refs
(Contract DE-AI03-79SF-10505)
(DOE/SF/10505-1) Avail: NTIS HC A03/MF A01

Factors to be used in candidate site selection were determined, factor maps were compiled, and the development of a hydrologic model of the river/reservoir system was initiated. In addition, initial performance and cost data were reviewed for three solar power systems. K.L.

N80-13665# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EVALUATION OF COMBINED PHOTOVOLTAIC/THERMAL COLLECTORS

S. D. Hendrie 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EG-77-S-02-4577)
(COO-4577-8; CONF-790541-54) Avail: NTIS HC A02/MF A01

The thermal and electric performance of an air and a liquid type combined photovoltaic/thermal solar collector was evaluated, yielding close correlation with theoretical results. Maximum thermal efficiencies of 42.5% and 40% for the liquid and air collectors without electric power production decreased to 40.4% and 32.9% when electrical power were produced. Maximum electrical efficiencies of 6.8% were measured. DOE

N80-13666# Oak Ridge National Lab., Tenn.
EXPERIMENTAL AND ANALYTICAL OTEC STUDIES AT ORNL

J. W. Michel 1979 8 p refs Presented at 6th OTEC Conf., Washington, D. C., 19 Jun. 1979
(Contract W-7405-eng-26)

(CONF-790631-1) Avail: NTIS HC A02/MF A01

Ammonia condensation tests were performed on several vertical fluted tubes and on tubes inclined at 30 deg from the vertical position. The high condensation coefficients reported for fluted tubes were verified. They seemed to be insensitive to tube length over the range tested. Also, tilting the tubes significantly improved the performance of smooth tubes and caused a slight decrease in the performance of fluted tubes. The cost effectiveness of various types of heat transfer enhancement were evaluated and heat exchanger joinability was surveyed. DOE

N80-13667# Franklin Pierce Law Center, Concord, N. H. Energy Law Inst.

FUNDAMENTAL ECONOMIC ISSUES IN THE DEVELOPMENT OF SMALL-SCALE HYDRO

Peter W. Brown and M. Ringo 15 Mar. 1979 28 p
(Contract RA-23-216.00.0)
(DOE/RA-23-216.00.0-02) Avail: NTIS HC A03/MF A01

The analysis presented is based on literature reviews, case studies, on-site visits, and particularly information from the Franklin Pierce - Thayer project. Broadly stated, economic analysis to data suggests that legal and regulatory constraints are the major obstacles for the slow development of SSH development. The economic picture of a hydro site as if it were a typical small business is described. The discussion is broken down into four parts, namely: costs, supply, demand and profitability. DOE

N80-13668# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

SOLAR COOLING PERFORMANCE IN CSU SOLAR HOUSE 3

D. S. Ward, J. C. Ward, and H. S. Oberoi Jan. 1979 20 p refs
(Contract EY-76-S-02-2858)

(COO-2858-23) Avail: NTIS HC A02/MF A01

Preliminary performance and pertinent operating experience with a liquid-heating flat-plate solar collector integrated with a residential solar heating and cooling system is presented. Data for the months of July and August (1978) are included, along with an analysis of the operation of the solar cooling system which utilizes the Yazaki 2-ton lithium bromide absorption chiller and a cool storage subsystem. Results of the analysis provide clear indications of the critical importance of temperature differentials between the collector outlet and the absorption chiller generator inlet, the effects of alternative control strategies, the marginal feasibility of cool storage, the devastating effect on system performance of the heat losses from the thermal storage unit, and the importance of parasitic power requirements on the ultimate feasibility of solar absorption cooling. DOE

N80-13669# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

TECHNOLOGY DEVELOPMENT NEEDS FOR HIGH TEMPERATURE PROCESS HEAT

Robert J. Copeland Aug. 1978 62 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-047) Avail: NTIS HC A04/MF A01

The potential utilization of high temperature solar thermal process heat was investigated. The petroleum industry was reviewed in some detail, and one candidate technology using hydrogen for energy transport was also investigated. Costs, land availability, and energy transfer were the key problem areas. With appropriate development all problems appeared solvable. More detailed evaluations of each large user industry were recommended. DOE

N80-13670# RCA Labs., Princeton, N. J.
MATERIALS FOR SOLAR THERMAL CONVERSION Final Report, 1 Sep. 1977 - 31 Aug. 1978

J. I. Gittleman and E. K. Sichel Sep. 1978 22 p refs
(Contract EG-77-C-02-4557)
(COO-4557-1; PRRL-78-CR-42) Avail: NTIS HC A02/MF A01

Composite semiconductors were produced by cosputtering Ge and Si with CaF_2 and their optical constants were measured. The normal specular reflectance of films sputtered on mirrored surfaces was measured. These data were used to compute the solar absorptance $\alpha/\text{sub s/}$ and thermal emittance $\epsilon/\text{sub th/}$. Thus at $T = 500^\circ\text{C}$ a conversion efficiency of 50 percent is possible at solar concentration ratios C of 7 to 8, and about 70 percent is possible for C approximately 40. It was concluded that a parabolic trough, a distributed receiver with a concentration ratio of 50 or less could be more economical for some applications than a central receiver for which $C > 500$, but the possibility of using these and other highly selective absorbers for the economical conversion of solar energy should be considered. DOE

N80-13671# Virginia Univ., Charlottesville.

EXPERIMENTAL AND THEORETICAL EVALUATION OF A NOVEL CONCENTRATING SOLAR ENERGY COLLECTION SYSTEM

Alexander B. Maish and J. Taylor Beard 1979 5 p refs
Presented at the 1979 Intern. Solar Energy Congr., Atlanta, 28-30 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-1053C; CONF-790541-3) Avail: NTIS HC A02/MF A01

A new concentrating solar energy system was evaluated theoretically and experimentally. The modular, two-axis tracking collector combined an aluminized mylar reflector with a flat plate absorber. Radiation collected from the 7 sq m frontal area was concentrated by a factor of five, making the collector suitable for intermediate temperature applications. The thermal performance of the collector was determined theoretically on a digital computer using a nodal approach to model the heat transfer processes. Collector sensitivities to environmental parameters were calculated. An experimental testing program conducted according to testing standards verified the predicted results. DOE

N80-13672# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

TRANS-SEASONAL STORAGE OF SOLAR ENERGY: INNOVATIVE RESEARCH PROGRAM SUBTASK Final Report, Dec. 1977 - Sep. 1978

W. D. Kemper and W. R. Walker Oct. 1978 27 p refs
(Contract EG-77-S-02-4546)
(COO-4546-3) Avail: NTIS HC A03/MF A01

The efficiencies and economics of long term storage of solar energy as low temperature heat in shallow underground reservoirs constructed using in situ soil materials are evaluated. Simulation models for predicting the movement of water and heat in response to temperature and capillary pressure gradients in partially saturated porous media are developed and conditions which might predict the rate and extent to which dry insulating blankets of soil form around hot buried reservoirs are simulated. The effect of confining barriers which restrict vapor and liquid flow of water is also simulated. The thermal conductivities of low cost and in situ materials which may be used in the construction of underground heat reservoirs are evaluated and methods of optimizing the thermal conductivities of these materials are developed. DOE

N80-13673# Los Alamos Scientific Lab., N. Mex.

HOT DRY ROCK GEOTHERMAL ENERGY DEVELOPMENT PROGRAM Annual Report, 1978

M. C. Brown, comp., R. B. Duffield, comp., C. L. B. Siciliano, comp., and M. C. Smith, comp. Apr. 1979 132 p refs
(Contract W-7405-eng-36)
(LA-7807-HDR) Avail: NTIS HC A07/MF A01

Run segments were completed in the prototype reservoir of the energy-extraction system at Fenton Hill, New Mexico. The tests yielded significant data on system flow parameters, water loss rates, geofluid chemistry, downhole flow impedance, operational constraints, mathematical modeling, technology and instrument capabilities, and environmental effects of operation. The technical results indicated that energy (thermal or electrical) from hot dry rock may be a feasible alternate energy source. Also, plans were prepared for a system with a commercial size reservoir that can demonstrate the production lifetime of such a system. DOE

N80-13674# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

WIND ENERGY INNOVATIVE SYSTEMS Technical Status Report, Jul. 1978

Irwin E. Vas Aug. 1978 58 p refs
(Contract EG-77-C-01-4042)
(SERI/PR-13-054) Avail: NTIS HC A04/MF A01

Economic and technical feasibility of innovative concepts and systems utilizing wind energy were investigated. Technical management of the 'wind energy innovative systems' program is discussed. The efforts of the current contracts are included within four major task areas: (1) theoretical thermodynamic and aerodynamic studies; (2) model design, fabrication, and test; (3) performance projections; and (4) economic evaluations. R.E.S.

N80-13675# Power Technologies, Inc., Schenectady, N. Y. **INDUCTION AND SYNCHRONOUS MACHINES FOR VERTICAL AXIS WIND TURBINES Final Report**

E. N. Hinrichsen Jun. 1979 123 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7017) Avail: NTIS HC A06/MF A01

The behavior of synchronous and induction generators driven by vertical axis wind turbines is described. The merits of the two types of machines are assessed. Major advantages of the synchronous generator are reactive power control and general acceptance by utility companies. The major advantage of the induction generator is excellent damping of torque pulsations. There is no significant difference in starting ability, efficiency, or voltage ripple. DOE

N80-13676# Oak Ridge National Lab., Tenn.

LAND-BASED APPLICATION OF AN OTEC OPEN-CYCLE POWER SYSTEM

F. C. Chen 1979 6 p refs Presented at 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790631-3) Avail: NTIS HC A02/MF A01

Application of OTEC power component technology to many land-based low temperature heat resources including rejected heat from thermal plants and Federal nuclear facilities, as well as freshwater thermoclines is considered. For utilizing rejected heat from large thermal power plants where OTEC range cold water is economically available, it is more cost-effective to apply OTEC open-cycle steam turbine technology for additional turbine stages for the conventional thermal power plant cycle rather than to add a separate bottoming cycle system. For utilizing rejected heat from Federal nuclear facilities, the open-cycle power system has its advantage because it does not need isolation heat exchangers to avoid cross contamination between the working fluid and the hot water supply. A simple thermal performance model and the thermal analysis of a conceptual rejected heat open-cycle power system corresponding to binary cycle system studies are presented. DOE

N80-13677# Los Alamos Scientific Lab., N. Mex.

CONCEPTUAL DESIGNS FOR TWO REJECT HEAT SYSTEMS FOR A BRAYTON CLOSED-CYCLE CONVERTER

G. A. Bennett May 1979 32 p refs
(Contract W-7405-eng-36)
(LA-7821-MS) Avail: NTIS HC A03/MF A01

Designs for two candidate reject heat systems (RHS) developed for a Brayton closed-cycle space nuclear power system are described. The most important constraints imposed on the design are the size and mass limits and the rigid survival standard of 99% probability that the RHS be functional at full power at the end of a seven-year mission. The secondary loop design includes a pumped-NaK radiator and a heat-pipe heat exchanger. The radiator is of conventional design with armored flow tube passages and fins arranged in rectangular panels placed at right angles to each other. The heat exchanger is a cylindrical pressure vessel with four radiator loops and two converter loops. The direct-pumped gas RHS is designed with many thin-walled, finned heat pipes placed side by side to form rectangular radiator panels that are arranged at right angles to each other. The gas heat exchanger is an armored manifold composed of multiple parallel

flow tubes placed at the evaporator end of the radiator heat pipes.
J.M.S.

N80-13678# University of Southern California, Los Angeles. Dept. of Materials Science.

LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLUTIONS Technical Quarterly Progress Report, 1 Dec. 1978 - 28 Feb. 1979

F. A. Kroeger 1979 5 p refs

(Contract EY-76-S-03-0113)

(SAN-0113-T3; TQPR-2) Avail: NTIS HC A02/MF A01

Electrodeposition studies using three possible silicon sources are reported. Improvements of the apparatus for the cathodic deposition of a-Si with the exclusion of air are discussed. Experiments are described which attempt to characterize the structure of the deposits. These include mass spectroscopy and X-ray diffraction analysis.
DOE

N80-13679# Ames Lab., Iowa.

FOSSIL ENERGY PROGRAM. 1. MINING RESEARCH AND DEVELOPMENT: COAL PREPARATION AND ANALYSIS Technical Progress Report, 1 Oct. - 31 Dec. 1978

May 1979 112 p

(Contract W-7405-eng-82)

(IS-4655) Avail: NTIS HC A06/MF A01

The objectives and progress for eight areas of the fossil energy program are reported. Research topics presented include the development of fine coal desulfurization and recovery technology, the microstructure of coal, the recovery of minerals from coal fly ash, and alloy evaluation for fossil fuel process plants.
A.W.H.

N80-13680# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

THERMAL PERFORMANCE OF BUILDINGS AND BUILDING ENVELOPE SYSTEMS: AN ANNOTATED BIBLIOGRAPHY William L. Carroll Apr. 1979 41 p Presented at the DOE/ASTM Thermal Insulation Conf., Tampa, Fla., 23-24 Oct. 1978

(Contract W-7405-eng-48)

(LBL-8925) Avail: NTIS HC A03/MF A01

A bibliography of published papers describing models, measurement techniques, apparatus, and data for the thermal performance of whole buildings and building envelope systems is presented. Summary descriptions of the content of each citation are provided. Citations on analytical models are selective and concentrate on methodology that forms the basis of computer programs for whole building energy analysis. Approached to dynamic measurements, both in the laboratory and in the field, for envelope systems and for whole buildings are included.
DOE

N80-13681# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

COGENERATION OPPORTUNITIES

1978 268 p refs Presented at Cogeneration Opportunities: A Symp. on Prospects for Ind. and Utility Gas, Oil and Coal-Fired Cogeneration, St. Louis, 6-7 Jun. 1978

(CONF-7806118) Avail: NTIS HC A12/MF A01

Thirteen unedited papers from a symposium covering government, industry, and utility cooperation in the use of waste energy for generating electricity and heat are presented. Specific topics discussed include process economics, institutional barriers to cogeneration, industrial cogeneration options, and utility experiences in cogeneration.
K.L.

N80-13686# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.

LARGE-SCALE ANNUAL-CYCLE THERMAL ENERGY STORAGE IN AQUIFERS

C. F. Meyer Apr. 1979 19 p refs Presented at Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May 1979

(Contract W-7405-eng-26)

(CONF-790515-3) Avail: NTIS HC A02/MF A01

Thermal energy storage in aquifers is examined. Potential benefits of aquifer storage in a large district heating/cogeneration system proposed for an urban area are discussed.
DOE

N80-13687# Lincoln Lab., Mass. Inst. of Tech., Lexington. **COST ANALYSIS OF PACKED BEDS FOR THERMAL ENERGY STORAGE**

N. I. Hamilton 3 Dec. 1978 36 p refs

(Contract EX-76-A-01-2295)

(CAES-11) Avail: NTIS HC A03/MF A01

A cost analysis of packed beds for thermal-energy storage (TES) in an adiabatic compressed-air-energy storage system is given. Capital costs based on the conceptual design of a TES unit are estimated and their sensitivity to system parameter variation is studied. Two TES conceptual designs were considered for: an excavated cavity, and an abandoned mine. A cost comparison is made between surface-sited and underground TES. A cost model was constructed to study the effect of pebble size, insulation thickness, temperature, storage pressure, storage capacity, and other TES components on the TES capital cost.
DOE

N80-13688# Battelle Columbus Labs., Ohio.

PHOTOVOLTAIC CONCENTRATOR APPLICATION EXPERIMENT. PHASE 1: A 150 kW PHOTOVOLTAIC CONCENTRATOR POWER SYSTEM FOR LOAD-CENTER APPLICATIONS WITH FEEDBACK INTO THE UTILITY GRID Final Report, 1 Jun. 1978 - 31 Mar. 1979

G. T. Noel, G. Alexander, L. H. Stember, G. H. Stickford, H. E. Smail, J. H. Broehl, and D. C. Carmichael Apr. 1979 123 p refs

(Contract ET-78-C-04-4267)

(DOE/CS-34267/1) Avail: NTIS HC A06/MF A01

A 150 kW peak concentrator-type photovoltaic power system was designed for multiple building load application. The system will operate in parallel with the utility grid (which provides backup power) to supply either or both of two service commercial buildings and will feed surplus power into the utility grid. System performance analysis indicates that the system will supply approximately 147,000 kWh/year to the primary load and an additional 55,000 kWh/year to the utility grid, in the single-load operational mode. The system design and the daily and seasonal match of system output with the load are described in detail. Plans are also discussed for installation and for operational evaluation of performance, economics, and institutional issues.
DOE

N80-13689# Argonne National Lab., Ill.

STATUS OF DEVELOPMENT, ENERGY AND ECONOMICS ASPECTS OF ALTERNATIVE TECHNOLOGIES

P. S. Farber, C. D. Livengood, K. E. Wilzbach, W. L. Buck, and H. Huang 1979 49 p refs Presented at 5th Flue Gas Desulfurization Symp., Las Vegas, Nev., 5 Mar. 1979

(Contract W-31-109-eng-38)

(CONF-790371-1) Avail: NTIS HC A03/MF A01

Several energy technologies under development throughout the world which either totally negate the need for flue gas desulfurization or require less than full flue gas scrubbing are examined. These processes remove sulfur either prior to coal combustion during combustion, or between two combustion stages. The status of development and/or demonstration of these technologies with respect to the possible application to the generation of electricity is reviewed. The overall coal to electrical energy efficiency and economics (capital costs and total annualized costs, mills/kWh) are explored, and compared for the various alternatives.
DOE

N80-13690# Los Alamos Scientific Lab., N. Mex.

CRITICAL REVIEW AND ASSESSMENT OF ENVIRONMENTAL AND SAFETY PROBLEMS IN HYDROGEN ENERGY SYSTEMS Progress Report, 1 Oct. 1977 - 30 Sep. 1979

F. J. Edeskuty, comp. and N. N. Sheheen, comp. May 1979 249 p refs

(Contract W-7405-eng-36)

(LA-7820-PR) Avail: NTIS HC A11/MF A01

The safety aspects and environmental problems of using hydrogen in energy systems are examined. Topics include hydrogen embrittlement, hydrogen dispersion after a gas leak of liquid spill, hydrogen combustion, an assessment of regulations and standards for hydrogen development, and hydrogen transmission through pipelines.
A.W.H.

N80-13691# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.

PHOTOVOLTAIC SYSTEMS. PROGRAM SUMMARY

Dec. 1978 366 p refs

(DOE/ET-0019/2) Avail: NTIS HC A16/MF A01

The photovoltaic systems program projects during fiscal year 1978 are described. The project sheets list the contractor, principal investigator, contract number and funding, and summarize the programs and status. The program is divided into various elements: program assessment and integration, research and advanced development, technology development, system definition and development, system application experiments, and standards and performance criteria. DOE

N80-13692# Lincoln Lab., Mass. Inst. of Tech., Lexington.

TEST PLAN FOR THE MEAD 25-KW PHOTOVOLTAIC FLEXIBLE TEST FACILITY, 1979

R. F. Hopkinson 15 Mar. 1979 21 p ref

(Contract EY-76-C-02-4094)

(COO-4094-53) Avail: NTIS HC A03/MF A01

The operations of the Mead 25-kW Photovoltaic System are reported along with descriptions on how the flexible test bed is expected to be used in experiments with a variety of PV applications, including irrigation, crop drying and fertilizer manufacturing. The planned operations for the Mead site during 1979 are given, and a schedule is attached. DOE

N80-13693# Sandia Labs., Albuquerque, N. Mex.

SANDIA LABORATORIES OPERATIONAL EXPERIENCE WITH SMALL HEAT ENGINES IN SOLAR THERMAL POWER SYSTEMS

Joseph P. Abbin, Jr. 1979 5 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-78-2163C; CONF-790803-23) Avail: NTIS HC A02/MF A01

Hardware and operating experience obtained from the construction and testing of two small Rankine-cycle solar thermal power plants are described. The first plant is part of a prototype solar total energy system with an electrical generating capacity of 32 kW, and the second plant is part of a prototype solar irrigation unit with a shaft power output of 19 kW or an electrical output of 15 kW. DOE

N80-13694# Lincoln Lab., Mass. Inst. of Tech., Lexington.

NOVEL CERAMIC RECEIVER FOR SOLAR BRAYTON SYSTEMS

Philip O. Jarvinen 1979 7 p Presented at ASME Gas Turbine Closed-Cycle Session, San Diego, Calif., 12-15 Mar. 1979

(Contract ET-78-S-02-4878)

(COO-4878-3; CONF-790305-7) Avail: NTIS HC A02/MF A01

Receivers for solar thermal heated air Brayton power systems are discussed. The ceramic domed cavity receiver concept is examined. The development of a high temperature seal for the solar heating air cavity receiver is reported. Mechanical dome sealing methods for this purpose are reviewed and investigations to establish the technological foundation of the seal concepts by demonstrating that ceramic domes can be designed to support the combined pressure, thermal stress, and temperature loads of a heated air receiver are presented. A.W.H.

N80-13695# Argonne National Lab., Ill.

MATERIALS TESTING FOR CENTRAL RECEIVER SOLAR-THERMAL POWER SYSTEMS

S. Majumdar 1978 13 p

(Contract W-31-109-eng-38)

(TID-29443) Avail: NTIS HC A02/MF A01

Biaxial creep-fatigue tests (constant tensile hoop stress and cyclic axial strain with hold times in compression) were performed on type 316H stainless steel superheater tubing. A comprehensive survey of information on sodium effects on candidate materials for solar-thermal electric piping and steam generators was conducted. Mechanical property data were generated in support of the ASME code development. DOE

N80-13696# Argonne National Lab., Ill.

OTEC POWER SYSTEMS

1979 14 p refs Presented at Offshore Technol. Conf., Houston, Tex., 30 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790444-2) Avail: NTIS HC A02/MF A01

The technical features of design studies of power systems using shell and tube heat exchangers and shell-less heat exchangers are presented. Heat exchanger design, biofouling control, rotating equipment, auxiliaries, plant layout, and system cost are among the areas discussed. The role of the power systems development program in the larger OTEC program is also discussed. DOE

N80-13697# Solarex Corp., Rockville, Md.

SILICON CONCENTRATOR SOLAR CELL MANUFACTURING DEVELOPMENT

C. Wrigley, G. Storti, and J. Wohlgemuth Nov. 1978 69 p refs

(Contract EY-76-C-04-0789)

(SAND-79-7021) Avail: NTIS HC A04/MF A01

The program to design and develop the manufacturing technology for silicon solar cells suitable for low-cost photovoltaic concentrator systems is summarized. Detailed discussions are presented for the following tasks: concentrator design, manufacturing process development, solar cell measurement and evaluation, results experienced in cell manufacturing, and production cost estimates. Conclusions and recommendations are given. In particular, it is found that (1) large area concentrator cells with 15% efficiency at 50 suns are readily manufacturable; (2) DOE cost goals for 1981 to 1982 can be met today with market volumes at 200 to 1000 sq m per year; and (3) respectable manufacturing yields are achievable with the technology now developed. DOE

N80-13698# Foster Wheeler Corp., Livingston, N.J.

INTERIM STRUCTURAL DESIGN STANDARD FOR SOLAR ENERGY APPLICATIONS, PHASES 1 AND 2 Final Report

I. Berman, A. C. Gangadharan, G. D. Gupta, and T. V. Narayanan Jan. 1979 148 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-8183) Avail: NTIS HC A07/MF A01

Central receiver solar thermal power systems, relevant ASME codes, reliability considerations, and the criteria used to develop the interim design standard is reviewed. The interim design standard is presented. All criteria or rules chosen or adapted from other codes are fully stated including all design data. A detailed paragraph-by-paragraph explanation of the interim design standard is provided. The test and development program needed to generate design data and to update the interim design standard are identified. DOE

N80-13699# Midwest Research Inst., Golden, Colo.

REVIEW OF SOLAR ENERGY Annual Report, 1977

Oct. 1978 179 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-54-066) Avail: NTIS HC A09/MF A01

A general review of national solar energy programs is provided. An executive summary and a brief history of the Federal solar energy program are presented. The issues and implications of the National Energy Plan that relate to solar energy development are discussed. The present Federal solar energy program is discussed, including the activities of several Federal agencies outside the Department of Energy. Some of the non-Federal solar energy programs are reviewed, including international programs in which the U.S. has some role, programs of state and local governments, college and university programs, the work of private industry, and individual and small scale activities. A synopsis of the major categories of solar technology is provided. A synopsis of major energy events of 1977; a glossary of technical terms, abbreviations, and acronyms, and a table of conversion factors are included. DOE

N80-13700# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT CDRL ITEM B.D., VOLUME 1 Final Report

C. R. Easton Aug. 1978 339 p

(Contract EG-77-C-03-1605)

(SAN-1605/7-Vol-1; MDC-G7399-Vol-1)

Avail: NTIS

HC A15/MF A01

The preliminary design of a heliostat for central receiver solar thermal power systems which projects to meet the DOE's goal of \$72/square m R at production volumes as low as 25,000 units per year and reduces to less than \$60/square m R in very high volume production (approximately 1,000,000 units per year) is presented. The manufacturing process, installation and checkout procedures, operation and maintenance procedures, and specification verification and optimization are described. DOE

N80-13701# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: WIND ENERGY CONVERSION

Jul. 1979 34 p refs

(DOE/EDP-0030) Avail: NTIS HC A03/MF A01

Projects or subprograms pertaining to windpower utilization that are likely to result in a demonstration or commercialization within the near term are presented. Projects that are expected to be considered in greater detail in the Environmental Development Plan update are identified. DOE

N80-13702# Ames Lab., Iowa.

FOSSIL ENERGY PROGRAM. 1. MINING RESEARCH AND DEVELOPMENT: COAL PREPARATION AND ANALYSIS Technical Progress Report, 1 Jan. - 31 Mar. 1979

Jun. 1979 31 p refs

(Contract W-7405-eng-82)

(IS-4703) Avail: NTIS HC A03/MF A01

The research and development technology in a number of areas in the fossil energy program are examined. Research topics discussed include the microstructure of coal, the development of an online monitoring instrument for pyrite and ash in coal, and coal blending experiments. A.W.H.

N80-13703# Electric Power Research Inst., Palo Alto, Calif.
SOLAR HEATING AND COOLING RESEARCH PROJECTS: A SUMMARY

Neal Lansing May 1979 30 p

(EPRI-ER-1095-SR) Avail: NTIS HC A03/MF A01

The major EPRI solar heating and cooling experiment projects are summarized. In addition to outlining each project and its purpose, the major features of the solar system are described. Also included are relatively detailed descriptions of the performance-monitoring equipment. As additional technical performance results are obtained and new projects added to the program, this document can be updated to include the new information. A basis for verification of analytic work aimed at determining the preferred solar system for any given utility service is provided, i.e., the system that provides the lowest total cost to the consumer and the utility. DOE

N80-13705# Department of Energy, Washington, D. C. Office of Energy Research.

THIN FILM PROBLEMS AND RESEARCH IN ENERGY SYSTEMS

Jan. 1979 159 p refs Presented at ERDA/DPR Symp. on Thin Film Res., Pacific Grove, Calif., 1 Nov. 1976

(CONF-761168-Summ) Avail: NTIS HC A08/MF A01

Presentations and recommendations for future efforts in thin film research for energy related applications are presented. Long term thin film coating needs of three programs whose purpose is to develop national energy sources, are described along with the current state of the art of thin film related technologies. DOE

N80-13706# Argonne National Lab., Ill.
COMMUNITY HEATING AND COOLING SYSTEMS

J. M. Calm Apr. 1979 9 p refs Presented at 4th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 9 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790446-6) Avail: NTIS HC A02/MF A01

Centralized, distributed, and cascaded heat pump centered integrated community energy systems (HP-ICES) approaches are discussed and an analysis showing their conservation potential is presented. Benefits of HP-ICES include reduction of adverse environmental effects, reliable production of services in view of increasingly frequent utility curtailments and interruptions, and provision of services at costs more favorable to consumers. DOE

N80-13707# Iowa State Univ. of Science and Technology, Ames.

ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Oct. - 31 Dec. 1978

A. E. Bergles, G. H. Junkhan, and R. L. Webb Mar. 1979 21 p refs

(Contract ET-78-S-02-4649)

(COO-4649-4) Avail: NTIS HC A02/MF A01

Research on energy conservation via heat transfer enhancement is summarized. Computerized retrieval files on technical literature, patents, and manufacturers were developed. DOE

N80-13708# Oak Ridge National Lab., Tenn.

INDUSTRIAL APPLICATIONS OF ADVANCED ENERGY SYSTEMS

J. E. Jones, Jr. 1979 3 p refs Presented at ANS Ann. Meeting, Atlanta, 3 Jun. 1979

(Contract W-7405-eng-26)

(CONF-790602-54) Avail: NTIS HC A02/MF A01

Industrial energy options based on coal and nuclear systems were assessed. Both high-temperature and low-temperature reactors were analyzed for heat process applications. In coal systems, a comparison was made of advanced energy conversion systems based on research and development experience. The important factors restricting the use of coal in industry were assessed. An atmospheric fluidized-bed combustion system for industrial cogeneration is discussed along with a preliminary market assessment for the technology. DOE

N80-13710# Sandia Labs., Albuquerque, N. Mex.

WEIGHT MINIMIZATION OF SANDWICH TYPE SOLAR COLLECTOR PANELS

R. C. Reuter, Jr. 1979 13 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979

(Contract EY-76-C-04-0789)

(SAND-78-2305C; CONF-790803-27) Avail: NTIS HC A02/MF A01

The existence, utilization and practicality of a minimum weight, adequately stiff design for sandwich panel construction in solar collector application was analytically evaluated. DOE

N80-13711# Rosenblatt (M.) and Son, Inc., New York.

OTEC PLATFORM CONFIGURATION AND INTEGRATION, EXECUTIVE SUMMARY Final Report

26 Jul. 1978 97 p

(Contract EG-76-C-01-4065)

(DOE/ET-4065/1) Avail: NTIS HC A05/MF A01

The commercialization of the ocean thermal energy conversion (OTEC) concept is discussed. Various areas of the OTEC plant development are examined. These include the design of a marine vessel to house the OTEC power cycle, the development of an OTEC power cycle, studies of the site environment, and the effects of biofouling and corrosion on any of the OTEC components. A.W.H.

N80-13713# Rosenblatt (M.) and Son, Inc., New York.

OTEC PLATFORM CONFIGURATION AND INTEGRATION, APPENDICES TO VOLUME 2 Final Report

7 Jul. 1978 159 p

(Contract EG-76-C-01-4065)

(DOE/ET-4065/1-Vol-2-App) Avail: NTIS HC A08/MF A01

Detailed information and conceptual design drawings for the spar and sphere platforms for an OTEC commercial plant are presented. A work breakdown structure and a detailed estimate of the spar platform weight are included. DOE

N80-13714# Rosenblatt (M.) and Son, Inc., New York.
OTEC PLATFORM CONFIGURATION AND INTEGRATION.
VOLUME 3: PROJECT PLAN Final Report

7 Jul. 1978 64 p refs

(DOE/ET-4065/1-Vol-3) Avail: NTIS HC A04/MF A01

The spar and sphere offshore platforms were used to demonstrate the feasibility of a near full size ocean thermal energy conversion (OTEC) plant and to gather data for use in the construction, design and operation of commercial OTEC plants. A hull size suitable to support a 100 MWe net output plant was chosen. Construction of the hull and installation of all equipment is proposed for three sites: (1) a shoreside construction site; (2) an offshore site in sufficient water depth to complete the hull erection; and (3) installation of the cold water pipe at the demonstration site.

DOE

N80-13715# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY. PART 1: EXPLORATION, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1978 - Jun. 1979

Audrey S. Hundemann Aug. 1979 264 p Supersedes NTIS/PS-78/0664; NTIS/PS-77/0561 Updates NTIS/PS-76/0463

(NTIS/PS-79/0814/8; NTIS/PS-78/0664; NTIS/PS-77/0561) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

The bibliography cites Federally-funded research on geophysical methods, such as electrical resistivity, seismology, magnetic anomaly, and electromagnetic measurements in geothermal site survey determination. Studies on well logging, remote sensing, geochemistry, mineralogy, radioactivity, mapping, volcanism, and structural geology are also cited. Criteria for location of geothermal areas are suggested in these abstracts. This updated bibliography contains 256 abstracts, 81 of which are new entries to the previous edition.

GRA

N80-13716# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY. PART 2: CORROSION AND EQUIPMENT, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1976 - Jul. 1979

Audrey S. Hundemann Aug. 1979 165 p Supersedes NTIS/PS-78/0665; NTIS/PS-77/0562 Updates NTIS/PS-76/0463

(NTIS/PS-79/0815/5; NTIS/PS-78/0665; NTIS/PS-77/0562) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

Citations of Government-sponsored research reports on corrosion and equipment studies related to geothermal energy are presented. Studies on pumps, turbines, drilling equipment, pipes, nozzles, and well casings are covered, along with studies on materials including concretes, steels and nonferrous alloys. Silica precipitation and scale formation on equipment are also cited. Performance of equipment in working fluids and brines and the chemical processes affecting performance are included. This updated bibliography contains 157 abstracts, 70 of which are new entries to the previous edition.

GRA

N80-13717# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY. PART 3: TECHNOLOGY AND GENERAL STUDIES, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1976 - Dec. 1977

Mona F. Smith Aug. 1979 247 p Updates NTIS/PS-76/0463

(NTIS/PS-79/0816/3) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

The bibliography covers Government-sponsored research on geothermal energy conversion, power plants, heat extraction, and space heating. Studies on fluid flow, heat transfer, rock fracturing, computerized simulation, pressure, and reservoir engineering are included. Reports on economics, legislation, technology assessment, comparative evaluation with other energy sources, Government policies, and planning are also cited. This updated

bibliography contains 239 abstracts, none of which are new entries to the previous edition.

GRA

N80-13718# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, May 1976 - Jul. 1978

Mona F. Smith Aug. 1979 329 p

(NTIS/PS-79/0818/9) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

Citations from worldwide literature on geothermal energy conversion, feasibility, development, and cost estimates are presented. Studies on geothermal exploration, drilling technology, fluid flow, convection, thermodynamics, heat extraction, and electric power plants are covered. Equipment, corrosion, reservoir engineering, and remote sensing are included. This updated bibliography contains 323 abstracts, none of which are new entries to the previous edition.

GRA

N80-13719# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY. PART 3: TECHNOLOGY AND GENERAL STUDIES, VOLUME 4. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1979

Audrey S. Hundemann Aug. 1979 203 p Supersedes NTIS/PS-78/0666; NTIS/PS-77/0563 Updates NTIS/PS-76/0463

(NTIS/PS-79/0817/1; NTIS/PS-78/0666; NTIS/PS-77/0563; NTIS/PS-76/0463) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

Research on geothermal energy conversion, power plants, heat extraction, and space heating is reported. Studies on fluid flow, heat transfer, rock fracturing, computerized simulation, pressure, and reservoir engineering are included. Reports on economics, legislation, technology assessment, and comparative evaluation with other energy sources, are presented. This updated bibliography contains 195 abstracts, all of which are new entries to the previous edition.

GRA

N80-13720# National Technical Information Service, Springfield, Va.

GEOHERMAL ENERGY, VOLUME 4. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Aug. 1978 - Jul. 1979

Audrey S. Hundemann Aug. 1979 149 p Supersedes NTIS/PS-78/0667; NTIS/PS-77/0565; NTIS/PS-76/0465

(NTIS/PS-79/0819/7; NTIS/PS-78/0667; NTIS/PS-77/0565; NTIS/PS-76/0465) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 081

Citations from worldwide literature on geothermal energy conversion, feasibility, development and cost estimates are presented. Studies on geothermal exploration, drilling technology, fluid flow, convection, thermodynamics, heat extraction, and electric power plants are covered. Equipment, corrosion, reservoir engineering, and remote sensing are included. This updated bibliography contains 143 abstracts, all of which are new entries to the previous edition.

GRA

N80-13723# Oregon State Univ., Corvallis. Air Resources Center.

CRITIQUE OF THE METEOROLOGICAL AND AIR QUALITY BASELINE MONITORING PROGRAM FOR THE PROTOTYPE OIL SHALE LEASEHOLDS. PART A: COMMENTS ON THE APPROACH TAKEN AND RECOMMENDATIONS FOR CONTINUING PROGRAM. PART B: COMMENTS ON THE DATA ACQUISITION AND MANAGEMENT

W. G. N. Slinn, M. A. Wolf, and J. P. Hennessey, Jr. Nov. 1978 58 p refs

(Contract EY-76-S-06-2227)

(DOE/EV-70031/4-Pt-A/B; RLO-2227-T31-4-Pt-A/B) Avail: NTIS HC A04/MF A01

The environmental impact is considered in the event that extensive oil shale resources of Colorado, Utah, and Wyoming are developed to augment the nation's energy needs. Reasons are suggested why existing knowledge is inadequate to provide

a valid answer. A means is proposed for accomplishing this important task within a suitable time-period and at a reasonable level of funding. The probable cause of deficiencies is identified in the meteorological and air quality data which were acquired over a two-year period on the Federal oil shale leaseholds and improved procedures for future data acquisition efforts are recommended. DOE

N80-13735# Cincinnati Univ., Ohio. Sedimentology Lab.
DEVONIAN PALEOCURRENTS OF THE APPALACHIAN BASIN

Paul Edwin Potter, Wayne A. Pryor, Paul Lundegard, Neil Samuels, and J. Barry Maynard May 1979 66 p refs
(Contract DE-AC21-76MC-05201)
(METC/CR-79/22) Avail: NTIS HC A04/MF A01

The methodology of paleocurrent studies in shaly basins based on both outcrops and oriented cores is set forth as is the relationship between paleocurrents and gas potential. The paleocurrent system of the central and northern Appalachian basin was found to be uniformly oriented to the west. Paleocurrent indicators are at right angles to isopach of total Devonian thickness, which decreases westward from 12,000 ft in eastern Pennsylvania to a few hundred ft in west central Ohio. This clastic wedge is largely of Upper Devonian age and includes alluvial and delta plain environments as well as shelf turbidite slope, and basin plain environments, the latter representing most of the black shales. The gradient of carbon isotopes, which shows more marine than terrestrial carbon in the western part of the basin, closely parallels the average paleocurrent direction of the basin. DOE

N80-13747# Northrop Services, Inc., Huntsville, Ala.

SOLAR-CLIMATIC STATISTICAL STUDY

Roger E. Bray Feb. 1979 570 p refs

(Contract EG-77-C-01-4016)

(HCP/T4016-01/2) Avail: NTIS HC A24/MF A01

Historic data (SOLMET) at 26 National Weather Service stations reporting hourly solar insolation and collateral meteorological information were examined to provide an estimate of future trends. Selected insolation and wind power conditions were investigated for their occurrence and persistence for defined periods of time on a monthly basis. Diurnal variations of wind power were also considered. Probability estimates of solar insolation and wind power, alone and in combination, occurring and persisting at or above specified thresholds are presented. Selected probability data for each station are presented graphically, and comprehensive plots for all stations are provided. Information of this nature is intended as an aid to preliminary planning activities for the design of solar and wind energy utilization systems. DOE

N80-13754# Mississippi State Univ., State College.

THE ANALYSIS OF SEDIMENT SAMPLES FOR HYDROCARBONS Final Report

Lewis Raymond Brown and Charles Douglas Minchew 30 Oct. 1978 72 p

(Contract DOT-CG-81-76-1476)

(AD-A073822; USCG-D-46-79; CGR/DC-12/79) Avail: NTIS HC A04/MF A01 CSCL 08/8

This document is a report on the hydrocarbon content of 1380 individual surficial samples obtained from areas in the vicinity of three proposed Deep Water Port (DWP) Sites in the Gulf of Mexico during six cruises taken between 1975 and 1978. The samples were analyzed using 2 different LC-fluorescent methods, one of which was selective for petrogenic hydrocarbons and one of which detected both petrogenic and biogenic hydrocarbons. Additionally, nutrient chemical analyses and microbiological analyses were performed on sediment obtained during the first two cruises. All data were evaluated statistically and discussed in terms of sources of inputs, effect on season, and significance for formulating an overall monitoring program for the DWP sites. The results of this study suggest that analysis for both petrogenic and biogenic hydrocarbons should be undertaken in order to more accurately reflect the sources of seasonal variation in hydrocarbon levels at sites of interest. A method of displaying the data is illustrated and discussed. It allows rapid comparisons of the hydrocarbon content of sediments from the various stations. GRA

N80-13872 Wisconsin Univ. - Madison.

NEWTON'S METHOD FOR GENERALIZED EQUATIONS AND THE PIES ENERGY MODEL Ph.D. Thesis

Norman Harold Josephy 1979 108 p

Avail: Univ. Microfilms Order No. 7922122

A number of results concerning the convergence and convergence rates of Newton and quasi-Newton methods for generalized equations are proven. Examples are given to emphasize the application of these methods to generalized equations representing the nonlinear programming problem and the nonlinear complementarity problem. Computational results of Newton's method are presented as applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. Solutions to a simplified version of PIES are obtained using a Newton method, and comparisons are made to solutions which appeared in the literature. Dissert. Abstr.

N80-13906# Los Alamos Scientific Lab., N. Mex.

BASILINE DESIGN OF THE THERMOELECTRIC REACTOR SPACE POWER SYSTEM

W. A. Ranken and D. R. Koenig 1979 8 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979

(Contract W-7405-eng-36)

(LA-UR-79-1242; CONF-790803-21)

Avail: NTIS

HC A02/MF A01

An extensive review of design alternatives for a nuclear reactor space power system capable of delivering 10 to 100 kW/sub e/ has led to the selection of a heat-pipe-cooled fast spectrum reactor with a thermoelectric power conversion system. The reactor design features a laminated core configuration with sheets of molybdenum - extending across the full diameter of the core - interspersed between layers of UO₂. Reactor heat is transferred by these sheets from the UO₂ to an array of 90 Mo/Na heat pipes that are spaced so that each receives equal power from an essentially uniform fuel loading in the core. This heat is transported by these heat pipes around the LiH shield to a ring of high-power-density thermoelectric modules constructed from modified SiGe alloys. Conversion takes place over a temperature interval of 1375 to 775 K with an efficiency of 9 percent. Residual heat is rejected by a conical radiator that is constructed from cross-coupled beryllium heat pipes. DOE

N80-13917# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
US PROGRAM FOR THE IMMOBILIZATION OF HIGH-LEVEL NUCLEAR WASTES

J. L. Crandall 8 Jun. 1979 25 p Presented at the Am. Nucl. Soc. Meeting, Atlanta, 3-8 Jun. 1979

(Contract EY-76-C-09-0001)

(DP-MS-79-2; CONF-790602-69)

Avail: NTIS

HC A02/MF A01

A program developed for the term management of high level nuclear waste is described. The program is designed to immobilize the high level waste in forms that act as highly efficient barriers against radionuclide release to the disposal site and to provide technology for similar treatment of commercial high level waste in case reprocessing of commercial nuclear fuels is ever resumed. Descriptions of commercial wastes, program strategy, program expenditures, development of waste forms, evaluation and selection of waste forms, regulatory aspects of waste form selection, project schedules, and cost estimates for immobilization facilities are discussed. DOE

N80-13941# Argonne National Lab., Ill.

FUSION POWER PROGRAM Quarterly Progress Report, Oct. - Dec. 1978

Apr. 1979 94 p refs

(Contract W-31-109-eng-38)

(ANL/FPP-78-4) Avail: NTIS HC A05/MF A01

Research and development areas in nuclear fusion are presented. Areas include: materials; energy storage and transfer; tritium containment, recovery and control; advanced reactor design; atomic data; reactor safety; fusion-fission hybrid systems; and alternate applications of fusion energy. Research progress

is reported for each of the following areas: (1) savings in plasma support systems for a Tokamak hybrid reactor; (2) fusion reactor safety studies; (3) energy storage and transfer; (4) test results of the 1.5 MJ pulsed superconducting coil; and (5) atomic data studies. DOE

N80-13989* Mechanical Technology, Inc., Latham, N. Y. Stirling Engine Systems Div.

ASSESSMENT OF THE STATE OF TECHNOLOGY OF AUTOMOTIVE STIRLING ENGINES

Sep. 1979 329 p refs

(Contracts DEN3-32; EC-77-A-31-10040)

(NASA-CR-159631; DOE/NASA/0032-79/4;

MTI-79ASE77RE2) Avail: NTIS HC A15/MF A01 CSCL 13F

The current status of automotive Stirling engine technology is considered. The energy is described and the history of its evolution is reviewed. Overall engine, component, subsystem and material problem areas are identified and recommendations are made for further development and testing. Potential improvements are also identified. Projected Stirling engine/vehicle performance is compared to that of vehicles using current internal combustion engine in terms of performance, fuel consumption, multifuel capability, emissions, and noise level. It is concluded that the potential for achieving 1984 program goals is clearly discernible. The program goals require at least a 30 percent reduction in fuel consumption, acceptable emissions, and the capability of satisfactorily operating with a variety of alternate fuels. A.R.H.

N80-14114* National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

PRELIMINARY TEST RESULTS OF A FLIGHT MANAGEMENT ALGORITHM FOR FUEL CONSERVATIVE DESCENTS IN A TIME BASED METERED TRAFFIC ENVIRONMENT

Charles E. Knox and Dennis G. Cannon (Boeing Commercial Airplane Co., Seattle, Wash.) Nov. 1979 34 p refs

(NASA-TM-80194) Avail: NTIS HC A03/MF A01 CSCL 01D

A flight management algorithm designed to improve the accuracy of delivering the airplane fuel efficiently to a metering fix at a time designated by air traffic control is discussed. The algorithm provides a 3-D path with time control (4-D) for a test B 737 airplane to make an idle thrust, clean configured descent to arrive at the metering fix at a predetermined time, altitude, and airspeed. The descent path is calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard pressure and temperature effects. The flight management descent algorithms and the results of the flight tests are discussed. A.W.H.

N80-14258* Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF THE STEAM-IRON PROCESS FOR HYDROGEN PRODUCTION. 9010 Quarterly Report. 1 Apr. - 30 Jun. 1978

Feb. 1979 62 p

(Contract EX-76-C-01-2435)

(FE-2435-32; QR-8) HC A04/MF A01

The operability of the two reactor steam-iron process was demonstrated for an extended period of time, and hydrogen was produced for the first time. Test 15 spanned a period of 24 days and included 106 hours of ore circulation, 36 hours of char feed, and 24 hours of self-sustained hydrogen production. The primary objective of this test was to demonstrate the operability of the steam-iron process. Producer bed temperatures were limited to 1600 F at 200 psig reactor pressure. The quantity of hydrogen produced, therefore, was low. Test 16, the second consecutive hydrogen-producing test, spanned a period of 7 days. Producer bed temperatures were increased to 1650 F to raise the production of hydrogen in the steam-iron reactor. As in Test 15, the reactor internals were completely clean and in excellent condition following the test. DOE

N80-14259* Naval Research Lab., Washington, D. C.
MICROBIAL DETERIORATION OF HYDROCARBON FUELS FROM OIL SHALE, COAL, AND PETROLEUM. 1: EXPLOR-

ATORY EXPERIMENTS Interim Report

Marian E. May and Rex A. Neihof 20 Aug. 1979 28 p refs (ZF57571004)

(AD-A073761; AD-E000316; NRL-MR-4060) Avail: NTIS HC A03/MF A01 CSCL 21/4

As part of the Navy's program on alternative sources of hydrocarbon fuel, the susceptibility to microbial deterioration of JP-5 derived from oil shale and coal (referred to as synthetic fuels) was investigated and compared with that of petroleum JP-5. Six fungi, including three strains of *Cladosporium resinae*, a yeast (*Candida*) and a bacterium (*Pseudomonas*) which normally grow well in association with petroleum JP-5 were used as test organisms in two-phase systems containing fuel/aqueous media. Most of the test organisms were inhibited to various extents in the presence of the synthetic fuels. An exception was a *Fusarium* species (fungus) which grew equally well under all three fuels. In mixtures of 75% petroleum and 25% synthetic fuels, microbial growth was generally equivalent to that in 100% petroleum JP-5. A search was made among samples of soil, creosoted wood and tree resins for microorganisms that could thrive in the presence of synthetic fuels. This endeavor produced a strain of *C. resinae* that grew as well with oil shale JP-5 as with petroleum JP-5. These exploratory experiments indicate that microorganisms adapted to growth with conventional petroleum fuel tend to be inhibited by synthetic fuels, but that organisms probably exist in nature which can readily adapt to and grow in the presence of synthetic fuels. GRA

N80-14263* Institute of Gas Technology, Chicago, Ill.

HIGH-Btu COAL GASIFICATION PROCESSES

C. F. Blazek, N. R. Baker, and R. R. Tison Jan. 1979 82 p refs Prepared for Argonne National Lab.

(Contract W-31-109-eng-38)

(ANL/CES/TE-79-2) Avail: NTIS HC A05/MF A01

Estimates of performance and cost data for advanced technology, high-Btu, coal gasification facilities are provided. The six processes discussed reflect the current state-of-the-art development. The information presented is based only on pilot-plant experience. Performance characteristics that were investigated include unit efficiencies, product output, and pollution aspects. Total installed plant costs and operating costs are tabulated for the various processes. The information supplied is expected to assist in selecting energy conversion units for an Integrated Community Energy System. DOE

N80-14264* SRI International Corp., Menlo Park, Calif.

PROCEEDINGS OF THE 1978 COAL CHEMISTRY WORKSHOP

S. B. Radding and Howard M. Peters Nov. 1978 204 p refs Conf. held at Menlo Park, Calif., 8-10 Mar. 1978

(Contract ET-78-X-01-2402)

(CONF-780372) Avail: NTIS HC A10/MF A01

The structural chemical analysis of coal and the chemistry of coal gasification and coal liquefaction are discussed. The DOE Fossil Energy Program is discussed in detail and recommendations for further research in coal gasification and coal liquefaction are made. DOE

N80-14265* Argonne National Lab., Ill.

EXPERIMENTAL VERIFICATION OF THE MERCURY-IODINE THERMOCHEMICAL CYCLE FOR THE PRODUCTION OF HYDROGEN FROM WATER, ANL-4

E. H. Appelman, F. Schreiner, and B. M. Abraham 1978 58 p refs Presented at the World Hydrogen Energy Conf., Zurich, 21 Aug. 1978

(Contract W-31-109-eng-38)

(CONF-780807-11) Avail: NTIS HC A04/MF A01

A flow diagram for the cycle described was constructed and an overall practical efficiency of 28% in terms of delta G/sub f (H2O)/total heat input) was estimated from the new data. A substantial portion of the total heat input is required for the isolation of the ammonium iodide. The cycle should be capable of producing hydrogen from water with reasonable efficiency and without requiring heat at an unduly high temperature. The cycle should therefore be suitable for a practical demonstration of the technical feasibility of thermochemical hydrogen generation. DOE

N80-14266# Department of Energy, Washington, D. C. Div. of Environmental Control Technology.

LIQUEFIED GASEOUS FUELS SAFETY AND ENVIRONMENTAL CONTROL ASSESSMENT PROGRAM Progress Report
May 1979 725 p refs
(Contracts EP-78-C-03-2057; EP-78-C-05-6020;
EP-78-C-02-4734; EE-77-S-02-4204; EE-77-S-02-4447;
EE-77-S-02-4548; EY-76-C-06-1830)
(DOE/EV-0036) Avail: NTIS HC A99/MF A01

Research is reported on the safety and environmental aspects of liquefied gaseous fuels including natural gas, petroleum gas, hydrogen, and ammonia. Spills and fires are among the handling, storage, and transportation hazards assessed. K.L.

N80-14269# Midwest Research Inst., Golden, Colo.
ROUGH COST ESTIMATES OF SOLAR THERMAL/COAL OR BIOMASS-DERIVED FUELS

R. J. Copeland 1979 8 p refs Presented at AIAA Terrestrial Energy Systems Conf., Orlando, Fla., 4 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-279; CONF-790611-5) Avail: NTIS HC A02/MF A01

Cost data for one method of producing synthetic methane is presented. A hybrid approach was chosen, a combination of solar thermal and either coal or biomass. The magnitude of the solar thermal resource is estimated as well as projected cost. Cost projections for coal and biomass are accumulated. The cost of synthetic gas from a hybrid and a conventional fuel source are compared. DOE

N80-14271# Argonne National Lab., Ill.
FUSARIUM SPECIES: THEIR POTENTIAL FOR TRANSFORMING BIOMASS TO ETHANOL

Antonios A. Antonopoulos Feb. 1979 26 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-38) Avail: NTIS HC A03/MF A01

Unlike yeasts and other fungi, *Fusaria* can ferment both pentoses and hexoses (yeast can ferment only hexoses), and are able to saccharify the cell wall and middle lamella constituents and ferment the released sugar units. Existing research data support well the idea of utilizing selected *Fusarium* strains to decompose and convert biomass to ethyl alcohol. Since ethanol blends and performs effectively with gasoline (as gasohol), its yield through the *Fusarium* fermentative action should be exploited. Certain biological, technological, and economic limitations that constrain the application of biomass conversion to ethanol by *Fusarium* strains today, on a large scale, could be overcome through additional research and development. DOE

N80-14272# California Univ., Davis. Dept. of Agricultural Engineering.

PILOT PLANT GASIFICATION TEST ON BIOMASS FUELS Interim Report, Jun. - Nov. 1978

John R. Goss Jun. 1979 79 p Sponsored by Calif. State Energy Resources Conserv. and Develop. Comm.
(PB-299077/8; CAEC-36; CAEC-500-79-007) Avail: NTIS HC A05/MF A01 CSCL 07A

A scaled-up version of Swedish down-draft gasifiers, capable of producing 8 million Btu of gas per hour from agricultural and forestry residues, operated over 500 hours which included a continuous run of 330 hours. The gas from the gasifier was burned in a boiler to produce steam, burned in a low-Btu burner to produce heated air, and burned in a 60 kw diesel engine to generate electricity. Data are presented on the operating characteristics, environmental impacts, and equipment costs of the gasifier system. The technical feasibility and requirements of firing steam boilers with low-Btu gas from a gasifier fueled with wood chips was demonstrated. GRA

N80-14273# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.

ASSESSMENT OF PRESENT STATE-OF-THE-ART SAWING TECHNOLOGY OF LARGE DIAMETER INGOTS FOR SOLAR SHEET MATERIAL Final Report, 1 Sep. 1977 - 28 Feb. 1978

H. I. Yoo 1978 126 p refs

(Contract JPL-954830)
(NASA-CR-162535; DOE/JPL-954830-78/2) Avail: NTIS HC A07/MF A01 CSCL 13H

Work is reported on: (1) slicing of the ingots with the multiblade slurry saw, the multiwire slurry saw and the I.D. saw, (2) characterization of the sliced wafers, and (3) analysis of add-on slicing cost based on Solar Array Manufacturing Industry Costing Standard. M.M.M.

N80-14279# General Accounting Office, Washington, D. C. Energy and Minerals Div.

THE SOLAR IN FEDERAL BUILDINGS DEMONSTRATION PROGRAM

10 Aug. 1979 24 p
(PB-298535/6; EMD-79-84) Avail: NTIS HC A02/MF A01 CSCL 13A

Recommendations are presented for DOE to develop a comprehensive strategy and plan for guiding and integrating conservation and solar efforts for Federal buildings in order to implement the Federal buildings solar program on the scale envisioned by the National Energy Plan and the Congress. GRA

N80-14346# Los Alamos Scientific Lab., N. Mex.

WAVE PROPAGATION IN A dc SUPERCONDUCTING CABLE. PART 1: ANALYSIS

P. Chowdhuri and Mary-Anne Mahaffy 1979 7 p refs Presented at the IEEE Summer Power Meeting, Vancouver, Canada, Jul. 1979

(Contract W-7405-eng-36)

(LA-UR-79-226; CONF-790713-1) Avail: NTIS HC A02/MF A01

A dc superconducting cable design consisting of four concentric metallic cylinders, of which two carry the load current and two comprise the cryogenic enclosure, was studied. The surge-voltage propagation characteristics of a four-conductor dc superconducting cable for a step-function input voltage was analyzed. This analysis, although mainly directed to superconducting cables, is also applicable to other multiconductor transmission lines. DOE

N80-14349# Department of Energy, Washington, D. C.

ELECTRIC AND HYBRID VEHICLES: COMMERCIALIZATION PHASE 3 PLANNING

R. C. Clusen Sep. 1978 37 p refs

(DOE/ERD-0004) Avail: NTIS HC A03/MF A01

A program to stimulate the commercialization of electric and hybrid vehicles (EHVs) as a partial solution to the oil consumption problem is presented. The commercialization of EHVs by the purchase or lease and demonstration of state-of-the-art and advanced vehicles through 1985 is described. The major vehicle categories are: (1) specific-mission electric vehicles; (2) general purpose electric vehicles; and (3) general purpose hybrid vehicles. The subjects covered are: the characteristics of the technology, status information on the technical and environmental research and development programs; a milestone chart representing a relationship between a considered commercialization schedule and relevant environmental research and development; and the environmental concerns significant to the technology. DOE

N80-14386# Rasor Associates, Inc., Sunnyvale, Calif.

A CESIUM TELEC EXPERIMENT AT LEWIS RESEARCH CENTER Final Report

E. J. Britt Sep. 1979 59 p refs

(Contract NAS3-21149)

(NASA-CR-159729; NSR-8-1) Avail: NTIS HC A04/MF A01 CSCL 20E

The thermoelectronic laser energy converter (TELEC), was studied as a method of converting a 10.6 mm CO₂ laser beam into electric power. The calculated characteristics of a TELEC seem to be well matched to the requirements of a spacecraft laser energy conversion system. The TELEC is a high power density plasma device which absorbs an intense laser beam by inverse bremsstrahlung with the plasma electrons. In the TELEC process, electromagnetic radiation is absorbed directly in the plasma electrons producing a high electron temperature. The

energetic electrons diffuse out of the plasma striking two electrodes which are in contact with the plasma at the boundaries. These two electrodes have different areas: the larger one is designated as the collector, the smaller one is designated as the emitter. The smaller electrode functions as an electron emitter to provide continuity of the current. Waste heat is rejected from the collector electrode. An experiment was carried out with a high power laser using a cesium vapor TELEC cell with 30 cm active length. Laser supported plasma was produced in the TELEC device during a number of laser runs over a period of several days. Electric power from the TELEC was observed with currents in the range of several amperes and output potentials of less than 1 volt. The magnitudes of these electric outputs were smaller than anticipated but consistent with the power levels of the laser during this experiment. J.M.S.

N80-14423* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
COAL-SHALE INTERFACE DETECTION SYSTEM Patent
 Richard A. Campbell, Jerry L. Hudgins, Paul W. Morris, Harry Reid, Jr., and Joe E. Zimmerman, inventors (to NASA) Issued 12 Jun. 1979 9 p Filed 3 Nov. 1977
 (NASA-Case-MFS-23720-2; US-Patent-4,157,655;
 US-Patent-Appl-SN-848421; US-Patent-Class-73-12;
 US-Patent-Class-73-82) Avail: US Patent and Trademark Office CSCL 081

A coal-shale interface detection system for use with coal cutting equipment consists of a reciprocating hammer on which an accelerometer is mounted to measure the impact of the hammer as it penetrates the ceiling or floor surface of a mine. A pair of reflectometers simultaneously view the same surface. The outputs of the accelerometer and reflectometers are detected and jointly registered to determine when an interface between coal and shale is being cut through.

Official Gazette of the U.S. Patent and Trademark Office

N80-14463# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 1: INTRODUCTION AND GENERAL SOCIAL CONTROLS Final Report, 1975 - 1978

Irving L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 180 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
 (Contract EPA-68-01-1916)
 (PB-299177/6; EPA-600/7-79-060A-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 081

The technologies likely to be used for development of coal, oil shale, uranium, oil, natural gas, and geothermal resources in eight western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) are described. The technological activities such as exploration, extraction, and conversion for developing the resource, and laws and regulations which affect the development of more than one of the six resources are considered. GRA

N80-14464# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 2: COAL Final Report, 1975 - 1978

Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 395 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
 (Contract EPA-68-01-1916)
 (PB-299178/4; EPA-600/7-79-060B-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 081

The characteristics of coal resources in the western United States are described. A regional overview of number, size, and types of the coal mining operations conducted in Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and

Wyoming, is presented. Conversion technologies such as coal gasification, liquefaction, and electrical generation are discussed. R.C.T.

N80-14465# Oklahoma Univ., Norman. Science and Public Policy Program.

ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 3: OIL SHALE Final Report, 1975 - 1978

Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al Mar. 1979 328 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
 (Contract EPA-68-01-1916)
 (PB-299179/2; EPA-600/7-79-060C-Vol-3) Avail: NTIS HC A15/MF A01 CSCL 081

The development of oil shale resources in eight Western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) is discussed. The energy resource base, the technologies used to develop the resource, and the inputs and outputs for each technology development are summarized. The laws and regulations applying to the deployment and operation of each technology are examined. R.C.T.

N80-14466# Oklahoma Univ., Norman. Science and Public Policy Program.

ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 4: URANIUM Final Report, 1975 - 1978

Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, and Rodney K. Freed Mar. 1979 255 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
 (Contract EPA-68-01-1916)
 (PB-299180/0; EPA-600/7-79-060D-Vol-4) Avail: NTIS HC A12/MF A01 CSCL 081

The technologies, inputs, outputs, laws and regulations associated with the development of uranium resources in eight western States (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming) are described. The exploration, mining, and milling of uranium are discussed and technological alternatives which represent potential development options are sited. Input requirements such as manpower, materials and equipment, economics, water, land, and ancillary energy are reported. Residuals that may pose environmental hazards are surveyed. R.C.T.

N80-14467# Oklahoma Univ., Norman. Science and Public Policy Program.

ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 5: OIL AND NATURAL GAS Final Report, 1975 - 1978

Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki, Edward B. Rappaport, Robert W. Rycroft, and Rodney K. Freed Mar. 1979 231 p refs Prepared in cooperation with Radian Corp., Austin, Tex. 6 Vol.
 (Contract EPA-68-01-1916)
 (PB-299181/8; EPA-600/7-79-060E-Vol-5) Avail: NTIS HC A11/MF A01 CSCL 081

The quantity and location of crude oil are discussed. The development of crude oil from exploration to treatment of finished products and enhanced recovery techniques are described. The social controls for crude oil transportation are reported. R.C.T.

N80-14468# Oklahoma Univ., Norman. Science and Public Policy Program.

ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT. VOLUME 6: GEOTHERMAL Final Report, 1975 - 1978

Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha Gilliland, Timothy A. Hall, Edward J. Malecki,

Edward B. Rappaport, Robert W. Rycroft, Rodney K. Freed et al
Mar. 1979 221 p refs Prepared in cooperation with Radian
Corp., Austin, Tex. 6 Vol.
(Contract EPA-68-01-1916)
(PB-299182/6; EPA-600/7-79-060F-Vol-6) Avail: NTIS
HC A10/MF A01 CSCL 081

The input requirements and outputs identified with the development and utilization of the geothermal resources of Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming are summarized. The characteristics of geothermal resources are discussed in terms of geology, location, quantity, physical and chemical characteristics and ownership.
R.C.T.

N80-14470# Environmental Monitoring and Support Lab., Las Vegas, Nev.

SURFACE WATER QUALITY PARAMETERS FOR MONITORING OIL SHALE DEVELOPMENT Final Report

W. L. Kinney, A. N. Brecheisen, and V. W. Lambou Mar. 1979
157 p refs
(PB-297984/7; EPA-600/4-79-018) Avail: NTIS
HC A08/MF A01 CSCL 13B

Listings of chemical, physical, and biological parameters which can be used to assess the environmental impact of oil shale development on surface water resources are given. Each of the potential water-related problems is addressed in the context of the probable cumulative regional impact of a maturing, commercial oil shale industry and in terms of local impact resulting from the prototype operation initially planned on leased public lands. The possible effects of potential pollutants on ambient water quality and the resulting impact on aquatic life, public water supplies, livestock, irrigation agriculture, and selected industries are evaluated.
GRA

N80-14471# New Mexico State Univ., Las Cruces.
DEEP TERRESTRIAL HEAT FLOW MEASUREMENTS IN NEW MEXICO AND NEIGHBORING GEOLOGIC AREAS Final Report, 1 Sep. 1976 - 30 Jun. 1978

Marshall Reiter Jun. 1979 85 p refs Prepared jointly with New Mexico Energy and Minerals Dept., Santa Fe and New Mexico Inst. of the Mining and Technology, Socorro
(Grant NSF GI-32482)
(PB-299489/5; NMEI-38) Avail: NTIS HC A05/MF A01 CSCL 081

Experimental aspects of continuous temperature logging, vertical groundwater movement correction for heat flow, and terrestrial heat flow and crustal radioactivity in northeastern New Mexico and southern Colorado are described.
GRA

N80-14472* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

SELF-RECONFIGURING SOLAR CELL SYSTEM Patent

Robert P. Gruber, inventor (to NASA) Issued 20 Nov. 1979
10 p filed 19 Jun. 1978 Supersedes N78-27520 (16 - 18, p 2408)

(NASA-Case-LEW-12586-1; US-Patent-4,175,249;
US-Patent-Appl-SN-916655; US-Patent-Class-323-15;
US-Patent-Class-307-63; US-Patent-Class-307-66;
US-Patent-Class-323-19) Avail: US Patent and Trademark Office CSCL 10A

A self-reconfiguring solar cell array is disclosed wherein some of the cells are switched so that they can be either in series or in shunt within the array. This feature of series or parallel switching of cells allows the array to match the load to achieve maximum power transfer. Automatic control is used to determine the conditions for maximum power operation and to switch the array into the appropriate configuration necessary to transfer maximum power to the load.

Official Gazette of the U.S. Patent and Trademark Office

N80-14473* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

SOLAR CONCENTRATOR Patent

John G. Simpson, inventor (to NASA) Issued 6 Nov. 1979
6 p Filed 30 Nov. 1977 Supersedes N78-13556 (16 - 04, p 0499)

(NASA-Case-MFS-23727-1; US-Patent-4,173,397;
US-Patent-Appl-SN-856465; US-Patent-Class-350-295;

US-Patent-Class-126-438; US-Patent-Class-350-296;
US-Patent-Class-126-442) Avail: US Patent and Trademark Office CSCL 10A

An improved solar concentrator is characterized by a number of elongated supporting members arranged in substantial horizontal parallelism with the axis and intersecting a common curve. A tensioned sheet of flexible reflective material is disposed in engaging relation with the supporting members in order to impart to the tensioned sheet a catenary configuration.

Official Gazette of the U.S. Patent and Trademark Office

N80-14474* National Aeronautics and Space Administration, Pasadena Office, Calif.

METHOD FOR FORMING A SOLAR ARRAY STRIP Patent

Robert I. Mueller (JPL) and Robert K. Yasui, inventors (to NASA) (JPL) Issued 13 Nov. 1979 7 p Filed 29 Mar. 1978 Supersedes N78-25560 (16 - 16, p 2138) Division of US Patent Appl. SN-809890, filed 24 Jun. 1977, US Patent-4,133,697 sponsored by NASA

(NASA-Case-NPO-13652-3; US-Patent-4,173,820;
US-Patent-Appl-SN-891358; US-Patent-Class-29-572;
US-Patent-Class-29-588; US-Patent-Class-29-627;
US-Patent-Class-136-89P; US-Patent-Appl-SN-809890;
US-Patent-4,133,697) Avail: US Patent and Trademark Office CSCL 10A

A flexible solar array strip is formed by a method which lends itself to automatic production techniques. Solder pads are deposited on printed circuitry deposited on a flexible structure. The resultant substrate is stored on a drum from which it is withdrawn and incrementally advanced along a linear path. Solderless solar cells are serially transported into engagement with the pads which are then heated in order to attach the cells to the circuitry. Excess flux is cleaned from the cells which are encapsulated in a protective coating. The resultant array is then spirally wound on a drum.

Official Gazette of the U.S. Patent and Trademark Office

N80-14475 Oklahoma State Univ., Stillwater.

A PROBABILISTIC STUDY OF WIND-ELECTRIC CONVERSION SYSTEMS FROM THE POINT OF VIEW OF RELIABILITY AND CAPACITY CREDIT Ph.D. Thesis

Raghvendra Rao Girirao Deshmukh 1979 167 p
Avail: Univ. Microfilms Order No. 7928197

Probabilistic models developed for wind energy conversion systems (WECS) are integrated with models of other power system components in order to evaluate the reliability of WECS assisted utility systems. A mathematical Weibull distribution function is used to model the actual wind speed distribution. It is shown that with a fixed wind regime and generation mix, an increase in the load demand causes only a slight increase in the risk index as long as the load value is less than or equal to the conventional generation capacity in the system. A load model based on the Markov chain with hourly peak load values is utilized in determining the load carrying capability of WECS assisted systems. The effect of including a transmission line is studied using two basic system configurations. It is shown that the interconnection of two WECS located in different wind regimes increases the availabilities of different capacities. Dissert. Abstr.

N80-14476 Mississippi State Univ., State College.

VISUALIZATION OF NATURAL CONVECTION IN FLAT PLATE SOLAR COLLECTORS Ph.D. Thesis

Benjamin Okechukwu Okeke 1979 154 p
Avail: Univ. Microfilms Order No. 7927095

The effects of variations in gap spacing on the convective heat flow patterns between the collector surface and the glazing were determined. Visual and photographic observations were made through transparent plexiglas side walls, using tobacco smoke to make the flow patterns visible. Results indicate that the critical Rayleigh number was only marginally dependent on variations to the air gap width. A substantial increase in the critical Rayleigh number was observed as the horizontal temperature gradient was increased. The first sign of natural convection was seen to be a set of steady side-by-side transverse rolls increasing in size towards the higher temperature end of

the test enclosure. Representative still photographs of the observed flow patterns are presented. Dissert. Abstr.

N80-14477 Kentucky Univ., Lexington.
PHOTOVOLTAIC ENERGY CONVERSION IN POLYMER FILMS Ph.D. Thesis

Harin Shrinivas Ullal 1979 219 p
 Avail: Univ. Microfilms Order No. 7927725

Photovoltaic energy conversion in poly-n-vinyl carbazole (PVK) and 2,4,7-trinitro-9-fluorenone (TNF) in the ratio (1:1) was investigated. It was determined that the maximum photovoltaic energy conversion efficiency is controlled by two critical parameters, namely the barrier height and the film thickness. The energy conversion efficiency was found to increase significantly by using low work function metal electrodes such as Sm. Conversely, by using high work function metal electrodes such as Pt, there is a marked decrease in the energy conversion efficiency. Also, there is a dramatic change in the energy conversion efficiency when there is a change in the film thickness. Model predictions and results of photoemission, dark current, and photocurrent studies are given. Dissert. Abstr.

N80-14478# PRC Energy Analysis Co., McLean, Va.
SATELLITE POWER SYSTEM (SPS): AN OVERVIEW OF PROSPECTIVE ORGANIZATIONAL STRUCTURES IN THE SOLAR SATELLITE FIELD

H. G. Edler Oct. 1978 19 p refs
 (Contract EG-77-C-01-4024)
 (TID-29094) HC A02/MF A01

A literature survey, interviews with acknowledged experts in the fields of organizational entities, space, solar energy, and the SPS concept, and an analysis of these inputs to identify the organizational alternatives and make judgments as to their feasibility to serve as patterns for a future SPS entity are presented. Selection and evaluation criteria were determined to include timeliness, reliability, and adequacy to contribute meaningfully to the U.S. supply; political feasibility (both national and international) and cost-effectiveness (including environmental and other external costs). Based on these criteria, four organizational alternatives are discussed which offer reasonable promise as potential options for SPS. These included three domestic alternatives and one international alternative. DOE

N80-14480* Power Electronics Associates, Inc., Lincoln, Mass.
BI-DIRECTIONAL FOUR QUADRANT (BDQ4) POWER CONVERTER DEVELOPMENT Final Report

Francis C. Schwarz 20 Dec. 1979 249 p refs
 (Contract NAS3-30363)
 (NASA-CR-159660) Avail: NTIS HC A11/MF A01 CSCL 10B

The feasibility for implementation of a concept for direct ac/dc multikilowatt power conversion with bidirectional transfer of energy was investigated. A 10 kHz current carrier was derived directly from a common 60 Hz three phase power system. This carrier was modulated to remove the 360 Hz ripple, inherent in the three phase power supply and then demodulated and processed by a high frequency filter. The resulting dc power was then supplied to a load. The process was implemented without the use of low frequency transformers and filters. This power conversion processes was reversible and can operate in the four quadrants as viewed from any of the two of the converter's ports. Areas of application include: power systems on air and spacecraft; terrestrial traction; integration of solar and wind powered systems with utility networks; HVDC; asynchronous coupling of polyphase networks; heat treatment; industrial machine drives; and power supplies for any use including instrumentation. R.C.T.

N80-14481* Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.

RESIDENTIAL PHOTOVOLTAIC MODULE AND ARRAY REQUIREMENTS STUDY, APPENDICES Final Report

S. L. Nearhoof and J. R. Oster Jun. 1979 560 p Sponsored by NASA Prepared for JPL and DOE

(Contract JPL-955149)

(NASA-CR-162529; DOE/JPL-955149-79/1-App) Avail: NTIS HC A24/MF A01 CSCL 10B

Regional building code variations, federal and city codes, and the national electric code are reviewed for their possible effects on the design of photovoltaic modules. Problems that photovoltaic arrays may impose on the insurability of residences are also discussed. Mounting configurations are developed for the modules, and grounding, wiring, terminal, and voltage requirements are established. Installation and materials costs are presented along with performance criteria. K.L.

N80-14482* Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.

RESIDENTIAL PHOTOVOLTAIC MODULE AND ARRAY REQUIREMENTS STUDY Final Report

S. L. Nearhoof and J. R. Oster Jun. 1979 64 p refs Prepared for JPL and DOE

(Contract JPL-955149)
 (NASA-CR-162528; DOE/JPL-955149-79/1) Avail: NTIS HC A04/MF A01 CSCL 10B

Design requirements for photovoltaic modules and arrays used in residential applications were identified. Building codes and referenced standards were reviewed for their applicability to residential photovoltaic array installations. Four installation types were identified - integral (replaces roofing), direct (mounted on top of roofing), stand-off (mounted away from roofing), and rack (for flat or low slope roofs, or ground mounted). Installation costs were developed for these mounting types as a function of panel/module size. Studies were performed to identify optimum module shapes and sizes and operating voltage cost drivers. It is concluded that there are no perceived major obstacles to the use of photovoltaic modules in residential arrays. However, there is no applicable building code category for residential photovoltaic modules and arrays and additional work with standards writing organizations is needed to develop residential module and array requirements. K.L.

N80-14483* Battelle Columbus Labs., Ohio.

DEVELOPMENT OF AN ACCELERATED TEST DESIGN FOR PREDICTING THE SERVICE LIFE OF THE SOLAR ARRAY AT MEAD, NEBRASKA Final Report

G. B. Gaines, R. E. Thomas, G. T. Noel, T. S. Shilliday, V. E. Wood, and D. C. Carmichael 7 Jun. 1979 61 p refs Prepared for JPL and DOE

(Contract JPL-954328)
 (NASA-CR-162534; DOE/JPL-954328-79/13) Avail: NTIS HC A04/MF A01 CSCL 10A

An accelerated life test is described which was developed to predict the life of the 25 kW photovoltaic array installed near Mead, Nebraska. A quantitative model for accelerating testing using multiple environmental stresses was used to develop the test design. The model accounts for the effects of thermal stress by a relation of the Arrhenius form. This relation was then corrected for the effects of nonthermal environmental stresses, such as relative humidity, atmospheric pollutants, and ultraviolet radiation. The correction factors for the nonthermal stresses included temperature-dependent exponents to account for the effects of interactions between thermal and nonthermal stresses on the rate of degradation of power output. The test conditions, measurements, and data analyses for the accelerated tests are presented. Constant-temperature, cyclic-temperature, and UV types of tests are specified, incorporating selected levels of relative humidity and chemical contamination and an imposed forward-bias current and static electric field. R.E.S.

N80-14484* General Electric Co., Cincinnati, Ohio.

A CONCEPTUAL DESIGN STUDY ON THE APPLICATION OF LIQUID METAL HEAT TRANSFER TECHNOLOGY TO THE SOLAR THERMAL POWER PLANT Final Report

W. F. Zimmerman, C. S. Robertson, C. L. Ehde, S. M. Divakaruni, and L. E. Stacy 25 Sep. 1979 166 p refs Sponsored by NASA Prepared for JPL and DOE

(Contract JPL-955018)
 (NASA-CR-162544; DOE/JPL-1060/28; GEAEP-54) Avail: NTIS HC A08/MF 01 CSCL 10A

Alkali metal heat transfer technology was used in the development of conceptual designs for the transport and storage of sensible and latent heat thermal energy in distributed concentrator, solar Stirling power conversion systems at a power level of 15 kWe per unit. Both liquid metal pumped loop and heat pipe thermal transport were considered; system configurations included: (1) an integrated, focal mounted sodium heat pipe solar receiver (HPSR) with latent heat thermal energy storage; (2) a liquid sodium pumped loop with the latent heat storage, Stirling engine-generator, pump and valves located on the back side of the concentrator; and (3) similar pumped loops serving several concentrators with more centralized power conversion and storage. The focus mounted HPSR was most efficient, lightest and lowest in estimated cost. Design confirmation testing indicated satisfactory performance at all angles of inclination of the primary heat pipes to be used in the solar receiver. Author

N80-14487* Purdue Univ., Lafayette, Ind.
ANALYSIS AND SIMULATION OF WIND ENERGY SYSTEMS
Final Report

P. C. Krause Nov. 1979 60 p refs
 (Grant NsG-3237)
 (NASA-CR-162538) Avail: NTIS HC A04/MF A01 CSCL 10A

Using a wind fluctuation model, simulation results of the mechanical and electrical systems were obtained for the MOD-2 wind turbine generator system. The dynamic performance of the MOD-2 was studied during wind gusts of the 1-cos form from a constant wind velocity. If these are the type of wind fluctuations to which the wind systems will be subjected to, then the design of the MOD-2 appears adequate. There was one exception to this; with a rate limit incorporated in the pitch controller, an instability occurred during a 'down' gust which caused continuous, unbounded switching between the high and low modes. This is a control design problem which appears to be correctable. R.E.S.

N80-14488* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

APPLICATION OF FIELD-MODULATED GENERATOR SYSTEMS TO DISPERSED SOLAR THERMAL ELECTRIC GENERATION

R. Ramakumar 15 Aug. 1979 94 p refs Sponsored in part by DOE
 (Contract NAS7-100; JPL Proj. 5102-136)
 (NASA-CR-162536; JPL-Pub-79-83; DOE/JPL-1060-25) Avail: NTIS HC A05/MF A01 CSCL 10A

The state-of-the-art of field modulated generation system (FMGS) is presented, and the application of FMGS to dispersed solar thermal electric generation is discussed. The control and monitoring requirements for solar generation system are defined. A comparison is presented between the FMGS approach and other options and the technological development needs are discussed. R.E.S.

N80-14491* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SOLAR THERMAL POWER SYSTEMS ADVANCED SOLAR THERMAL TECHNOLOGY PROJECT, ADVANCED SUB-SYSTEMS DEVELOPMENT Semiannual Progress Report, 1 Oct. 1978 - 1 Apr. 1979

15 Aug. 1979 110 p Original contains color illustrations
 (Contracts NAS7-100; DE-AI01-79ET-20307; JPL Proj. 5102-117)

(NASA-CR-162546; DOE/JPL-1060-20; JPL-Pub-79-107; SAPR-3) Avail: NTIS HC A06/MF A01 CSCL 10B

The preliminary design for a prototype small (20 kWe) solar thermal electric generating unit was completed, consisting of several subsystems. The concentrator and the receiver collect solar energy and a thermal buffer storage with a transport system is used to provide a partially smoothed heat input to the Stirling engine. A fossil-fuel combustor is included in the receiver designs to permit operation with partial or no solar insolation (hybrid). The engine converts the heat input into mechanical action that powers a generator. To obtain electric power on a large scale, multiple solar modules will be required to operate in parallel.

The small solar electric power plant used as a baseline design will provide electricity at remote sites and small communities.

Author

N80-14492* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SILICON MATERIALS OUTLOOK STUDY FOR 1980-1985 CALENDAR YEARS

E. Costogoue, R. Ferber, W. Hasbach, R. Pellin, and C. Yaws 1 Nov. 1979 74 p refs Sponsored in part by DOE
 (Contract NAS7-100; JPL Proj. 5230-1-Rev-A)
 (NASA-CR-162541; JPL-Pub-79-110; DOE/JPL-1012-33)
 Avail: NTIS HC A04/MF A01 CSCL 10A

The polycrystalline silicon industry was studied in relation to future market needs. Analysis of the data obtained indicates that there is a high probability of polycrystalline silicon shortage by the end of 1982 and a strong seller's market after 1981 which will foster price competition for available silicon. R.E.S.

N80-14493* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

STATUS OF THE DOE/NASA CRITICAL GAS TURBINE RESEARCH AND TECHNOLOGY PROJECT

John S. Clark 1980 21 p refs Proposed for presentation the 25th Annual Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by the Am. Soc. of Mech. Engineers
 (Contract EF-77-A-01-2593)
 (NASA-TM-79307; DOE/NASA/2593-79/11; E-263) Avail: NTIS HC A02/MF A01 CSCL 10B

Activities performed in order to provide an R&T data base for utility gas turbine systems burning coal-derived fuels are described. Experiments were run to determine the corrosivity effects of trace metal contaminants (and potential fuel additives) on gas turbine materials and these results were correlated in a corrosion-life prediction model. Actual fuels were burned in a burner rig hot corrosion test to verify the model. A deposition prediction model was assembled and compared with results of actual coal-derived fuel deposition tests. Thermal barrier coatings were tested to determine their potential for protecting gas turbine hardware from the corrosive contaminants. Several coatings were identified with significantly improved spallation-resistance (and, hence, corrosion resistance). A.R.H.

N80-14494* Rensselaer Polytechnic Inst., Troy, N. Y. Center for Architectural Research.

BARRIERS TO THE APPLICATION OF WIND ENERGY CONVERSION SYSTEMS IN URBAN SETTINGS

Robert E. Duffy, Walter M. Kroner, ed., Michael Kwartler, and George W. Ulseth Dec. 1979 176 p refs Sponsored by New York State Energy Res. and Develop. Authority
 Avail: NTIS HC A09/MF A01

The issues which arise through such activities as the planning/building regulatory process, location selection, mounting or installation, and operation and maintenance of wind energy conversion systems (WECS) were identified and analyzed in relation to their legal environmental, technical, institutional, economic, safety, and social impacts. Case studies and simulation were performed, and potential differences in barriers described in national publications were compared with conditions unique to the northeast region and/or to New York State. Those urban areas in New York State where sufficient wind power is available for WECS consideration were identified, and the legal instruments and jurisdictional constraints relevant to them were analyzed. A.R.H.

N80-14495* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

DEVELOPMENT AND TESTING OF THE JUNKKEEPER CONTROL CORPORATION INTEGRATED PROGRAMMABLE ELECTRONIC CONTROLLER AND HYDRONICS PACKAGE Final Report

James D. Hankins Aug. 1979 21 p refs
 (NASA-TM-78244) Avail: NTIS HC A02/MF A01 CSCL 10A

Additional developmental work on the existing programmable electronic controller and hydronic package for use with solar heating and cooling systems is summarized. The controller/hydraulics subsystems passed all acceptance tests and performance criteria. The subsystems were shown marketable for public use.
R.E.S.

N80-14496*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE RHO SIGMA INCORPORATED MICROPROCESSOR CONTROL SUBSYSTEM Final Report
James D. Hankins Oct. 1979 23 p refs Sponsored in part by DOE
(Contract NAS8-32256)
(NASA-TM-78246) Avail: NTIS HC A02/MF A01 CSCL 10A

Product development and performance tests of three programmable microprocessor controllers for use with solar heating and cooling systems are presented. The products were developed to be marketable for public use.
R.E.S.

N80-14497*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
THERMAL PERFORMANCE EVALUATION OF THE SUNCATCHER SH-11 (LIQUID) SOLAR COLLECTOR
Jul. 1980 22 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161253) Avail: NTIS HC A02/MF A01 CSCL 10A

The procedures used and the results obtained during the evaluation test program on the Solar Unlimited, Inc., Suncatcher SH-11 (liquid) solar collector are presented. The flat-plate collector case assembly is made of .08 inch aluminum 3003 H14 riveted with fiberglass board insulation. The absorber consists of collared aluminum fins mechanically bonded to 3/8 inch copper tubing and coated with 3M Nextel black. Water is used as the working fluid. The glazing is made of a single glass, 1/8 inch water white, tempered and antireflective. The collector weight is 85 pounds with overall external dimensions of about 35.4 in x 82.0 in x 4.0 in. Thermal performance data on the Solar Unlimited Suncatcher SH-11 solar collector under simulated conditions were conducted using the MSFC Solar Simulator.
M.M.M.

N80-14498*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE SOLAR CONTROL CORPORATION MODULAR CONTROLLER AND SOLAR-STAT SUBSYSTEM Final Report
James D. Hankins Aug. 1979 15 p refs Prepared for DOE Prepared by Solar Control Corp., Boulder, Colo.
(Contract NAS8-32258)
(NASA-TM-78243) Avail: NTIS HC A02/MF A01 CSCL 10A

Results of development work on an existing controller and solarstat subsystem for use with solar heating and cooling systems are presented. The deliverable end items, program objectives, and how they were accomplished are described. It is shown that the products developed are marketable and suitable for public use.
J.M.S.

N80-14499*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT, TESTING AND CERTIFICATION OF THE SIGMA RESEARCH, MAXI-THERM-S-101 THERMOSYPHON HEAT EXCHANGER Final Report
James D. Hankins Oct. 1979 19 p refs
(NASA-TM-78245) Avail: NTIS HC A02/MF A01 CSCL 10A

A thermosyphon liquid-to-air heat exchanger developed for use in heating systems in residential single family dwellings and small commercial applications is described. The cabinet design, rationale for the horizontal positioning of the exchanger, and design of the shut-off valve are discussed. The performance of the heating module is given in tabular form.
J.M.S.

N80-14500*# Wyle Labs., Inc., Huntsville, Ala.
RESULTS OF THERMAL PERFORMANCE EVALUATION OF THE OWENS-ILLINOIS SUNPACK LIQUID SOLAR COLLECTOR AT INDOOR CONDITIONS
10 Oct. 1979 28 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161189) Avail: NTIS HC A03/MF A01 CSCL 10A

Test procedures and results of the thermal performance of a liquid, evacuated tube, solar collector under simulated conditions are presented. The collector tested was a module used on the early demonstration projects.
R.E.S.

N80-14501*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
COMPUTER PROGRAM FOR ASSESSING THE ECONOMIC FEASIBILITY OF SOLAR ENERGY FOR SINGLE FAMILY RESIDENCES AND LIGHT COMMERCIAL APPLICATIONS
J. Alan Forney (Systems Analysis and Integration Lab.), David Walker (Computer Sciences Corp., Huntsville, Ala.), and Mike Lanier (Computer Sciences Corp., Huntsville, Ala.) Sep. 1979 147 p
(NASA-TM-78251) Avail: NTIS HC A07/MF A01 CSCL 10B

Computer program, SHCOST, was used to perform economic analyses of operational test sites. The program allows consideration of the economic parameters which are important to the solar system user. A life cycle cost and cash flow comparison is made between a solar heating system and a conventional system. The program assists in sizing the solar heating system. A sensitivity study and plot capability allow the user to select the most cost effective system configuration.
M.G.

N80-14502# Boston Univ., Mass. Dept. of Chemistry.
PHOTOSENSITIZATION MECHANISMS FOR ENERGY STORING ISOMERIZATIONS Technical Report, 1 Nov. 1976 - 28 Feb. 1979
Guilford Jones, II, Phan Thanh Xuan, and Sheau Hwa Chiang 1 Jul. 1979 32 p refs
(Contract N00014-76-C-0442)
(AD-A074968; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

The results of a study of photochemical storage of radiant energy in organic molecules are reviewed and prospects for the reversible storage of solar energy outlined. A number of intramolecular cycloaddition reactions are identified as candidates for efficient photochemical energy storage and findings concerning the mechanisms of these reactions are discussed. Strategies for the photosensitization of reactions to visible light are evaluated. The use of wavelengths past 500 nm is demonstrated for an energy storing isomerization which is efficiently driven by a triplet energy transfer mechanism.
GRA

N80-14503# Boston Univ., Mass. Dept. of Chemistry.
ENERGY STORING ORGANIC PHOTOREACTIONS Final Report, 1 Nov. 1975 - 28 Feb. 1979
G. Jones, II 1 Aug. 1979 11 p refs
(Contract N00014-76-C-0442)
(AD-A074915) Avail: NTIS HC A02/MF A01 CSCL 10/3

Results of a study of energy storing organic photoreactions are summarized. Discussion includes criteria for efficient photon energy storage, quantum yield and other quantitative results for a variety of photoisomerization and photoaddition reactions, the nature of intermediates for these photoreactions, photochemistry of charge-transfer complexes, and prospects for photochemical storage of solar energy.
GRA

N80-14504# Dayton Univ., Ohio. School of Engineering.
ANALYSIS OF REMOTE SITE ENERGY STORAGE AND GENERATION SYSTEMS Final Technical Report, Jul. 1978 - Jun. 1979
J. N. Crisp, W. S. Bishop, J. D. Pinson, and L. A. Anderson Jul. 1979 148 p refs
(Contract F33615-77-C-004)

(AD-A074869; UDR-TR-79-35; UDSE-TR-79-02; AFESC/ESL-TR-79-20) Avail: NTIS HC A07/MF A01 CSCL 10/2

This report presents the results of an investigation and analysis of energy storage systems and alternate energy sources for remote site applications. The first phase of the effort centered on the broad based study of hydrogen storage, thermal storage, batteries, and flywheels as energy storage systems along with wind turbine, solar photovoltaic, and solar thermionic energy converters. A wind turbine battery system was recommended based on performance, cost and availability. Effort under the second phase of the program concentrated on a system using two separate nominal eight kilowatt wind turbine modules in conjunction with a lead-acid battery energy storage unit. The system was specified to operate in conjunction with an existing power grid system located at Bar Main, Barter Island, Alaska. Specific system concepts and recommendations are presented with supporting analyses. A design checklist is included with specific items for consideration in the preparation of a design specification. GRA

N80-14505# GTE Sylvania, Inc., Needham Heights, Mass. Communications Systems Div.

LITHIUM INORGANIC ELECTROLYTE BATTERY DEVELOPMENT Interim Report, Jun. 1977 : Oct. 1978

F. Goebel Apr. 1979 60 p refs

(Contract F33615-77-C-2021; AF Proj. 3145)

(AD-A073858; AFAPL-TR-79-2026)

Avail: NTIS

HC A04/MF A01 CSCL 10/3

This report presents the results of the first half of a three year program to conduct exploratory development to improve the safety/performance characteristics of lithium anode/inorganic electrolyte batteries. Development has been conducted in 3 major areas: capacity retention of cylindrical cells, low temperature capability of cylindrical cells, and abuse tests of cylindrical and prismatic cells. Significant accomplishments include providing capacity down to the 3.0 volt level cutoff at -40 degrees and no venting or explosion of cells during abuse tests, except during incineration when it is expected. GRA

N80-14508# Department of Energy, Washington, D. C. **COMMERCIALIZATION STRATEGY REPORT FOR HYDROTHERMAL ELECTRIC AND DIRECT HEAT APPLICATION** R. A. Black, J. V. Dionne, L. Falick, and E. B. Harvey [1979] 98 p

(TID-2884-Draft) Avail: NTIS HC A05/MF A01

The use of vapor dominated hydrothermal resources for production of electric power is discussed. The ability to handle high temperature, low to moderate-salinity geofluids and convert the heat to usable power using existing technology is reviewed. The use of high temperature, high salinity brines, and moderate temperature resources is examined for economic operation. Technical risks and environmental acceptability are discussed along with technical, market/economic, environmental, institutional readiness, and benefit analysis. A commercialization plan for hydrothermal electric and direct heat applications is presented. DOE

N80-14509# Oak Ridge National Lab., Tenn. **OUTLOOK FOR NUCLEAR FISSION ENERGY**

T. D. Anderson 1978 14 p refs Presented at 2d Ann.

Intern. Conf. on Energy, Washington, D.C.

(Contract W-7405-eng-26)

(CONF-7811126-1) Avail: NTIS HC A02/MF A01

The status of nuclear power as an energy source is discussed. The development of light water breeder reactors for electric power generation is examined. Present nuclear energy research and development are reported. The electric utility industry's commitment to nuclear power and the effects of the energy crisis on the nuclear power industry are examined. A.W.H.

N80-14510# Little (Arthur D.), Inc., Cambridge, Mass. **ENERGY ANALYSIS OF THE BASIC MATERIALS UTILIZED IN ELECTRIC POWER TRANSMISSION SYSTEMS**

30 Apr. 1979 353 p

(Contract EC-77-C-01-5043)

(HCP/T5043-01) Avail: NTIS HC A16/MF A01

The energy content per mile of installed underground and overhead power transmission systems was calculated for the following types of systems: self contained oil filled cables; HPOF pipe type cables; extruded dielectric cables; compressed gas insulated systems; overhead lines (ac and dc); and two proposed superconducting systems (ac and dc). The system operating voltages analyzed included 138, 230, 345, 500, 765 and 1,200 kV for ac systems. Systems were not analyzed at the higher voltages. Installation energy requirements, generally 10% or less of the inherent system energy content based on the materials used in each system, are discussed. The energy content of 36 materials and basic products, in terms of Btu per ton, was calculated. Substitution of conductor materials (e.g., aluminum for copper) in cable systems are examined in relation to total system energy content. DOE

N80-14511# Tennessee Univ., Knoxville. Dept. of Civil Engineering.

SIMULATION APPROACH FOR BASE-LINE ENERGY-SITING ANALYSIS

R. L. Church and E. L. Hillsman (Oak Ridge Natl. Lab., Tenn.)

1979 16 p refs Presented at Instrument Soc. of Am., Pittsburgh Modeling and Simulation Conf., Pittsburgh, 25 Apr. 1979

(Contract W-7405-eng-26)

(CONF-790459-22) Avail: NTIS HC A02/MF A01

A simulation model for predicting regional energy-siting patterns is discussed. The model results are used to project regional environmental and economic impacts for DOE. Emphasis is placed on modifications, which include casting the siting decision within a multiobjective framework and including intermediate optimizing capabilities to meet water resource and other constraints. DOE

N80-14512# Brookhaven National Lab., Upton, N. Y. **HIGHLIGHTS OF THE ENERGY TECHNOLOGY PROGRAMS** Annual Report

Dec. 1978 49 p

(Contract EY-76-C-02-0016)

(BNL-50959) Avail: NTIS HC A03/MF A01

Activities in: electrolysis based hydrogen energy storage systems; an electrochemically regenerative hydrogen-halogen energy storage system; fuel cells (materials and electrolysis); high temperature water electrolysis; and hydrogen energy storage systems for automobile propulsion are summarized. Energy programs reported on include: solar assisted heat pump systems; solar cooling subsystems and systems; solar demonstration projects; hardware simulators for tests of solar cooling/heating systems; fossil energy programs; catalytic process for conversion of synthesis gas to methanol; coal fired heater; coal/oil mixture combustion; rotating fluidized bed containing limestone for removal of sulfur from hot gases; improved oil and gas burners; and residue and waste fuels. DOE

N80-14514# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

DYNAMIC ENERGY SYSTEM OPTIMIZATION MODEL

E. A. Cherniavsky, L. L. Juang, and H. Abilock May 1979 119 p

(Contract EY-76-C-02-0016)

(EPRI-EA-1079) Avail: NTIS HC A06/MF A01

The dynamic energy system optimization model (DESOM) developed to investigate the roles of different technologies in the energy system over an extended period of time is discussed. Means to improve computational features of the program, to incorporate electric sector detail into the existing version of DESOM, and to transfer the DESOM model to EPRI are examined. DOE

N80-14515# Department of Energy, Washington, D. C. Office of State and Local Governments.

REPORT TO THE CONGRESS ON THE COORDINATION OF FEDERAL ENERGY CONSERVATION PROGRAMS INVOLVING STATE AND LOCAL GOVERNMENTS

May 1979 117 p

(DOE/TIC-10127) Avail: NTIS HC A06/MF A01

Four laws which authorize the government to develop and implement specific energy conservation programs are discussed.

The development, implementation, and administration of the energy programs are examined and the coordination activities between Federal, State, and Local governments on the energy programs are analyzed. A.W.H.

N80-14516# Illinois Univ., Urbana. Center for Advanced Computation.

NEW HYBRID 1971 ENERGY INTENSITIES, PART 1 Final Report

P. S. Penner, R. A. Herendeen, and T. Milke Dec. 1978 9 p refs

(Contract EM-78-S-02-4628)

(COO-4628-4-Pt.1) Avail: NTIS HC A02/MF A01

A set of hybrid energy intensities from 1971 direct energy use data and 1967 economic input/output information are computed and discussed. Energy intensities represent the total energy used through the economy to produce one unit of output from each of the 90 sectors defined as spanning the U.S. economy in 1967. The data base discussed contains, among other items, data on the consumption of over 100 fuel types by 154 consuming sectors in the U.S. economy. DOE

N80-14517# California Univ., Livermore. Lawrence Livermore Lab.

US ENERGY FLOW IN 1978

W. J. Ramsey 11 Jun. 1979 6 p

(Contract W-7405-eng-48)

Avail: NTIS HC A02/MF A01

An energy flow diagram for the U.S. for 1978 is presented. Some significant differences between 1977 and 1978 are: total energy use increased 1.8%; oil imports decreased to 17.4 quads, more than 7% below 1977; coal and natural gas remained about constant; the industrial sector remains unique in that its energy use decreased somewhat due to conservation efforts; delivered nuclear power increased by 8%, supplying one-eighth of all electricity; and a trend toward electrification continued with distributed electrical energy increasing by 3.9%. DOE

N80-14518# Midwest Research Inst., Golden, Colo. **APPLICATION OF DIFFUSION RESEARCH TO SOLAR ENERGY POLICY ISSUES**

J. D. Roessner Mar. 1979 35 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-51-194) Avail: NTIS HC A03/MF A01

Two types of information requirements that appear to be basic to DOE solar energy policy decisions are examined: (1) how can the future market success of solar energy technologies be estimated, and (2) what factors influence the adoption of solar energy technologies, and what specific programs could promote solar energy adoption most effectively? The ability of a body of research, referred to here as diffusion research, to supply information that could partially satisfy these requirements is assessed. The strengths and limitations of current knowledge about the diffusion of innovations are summarized, the applicability of both existing knowledge and the diffusion approach to the identified solar energy policy issues are discussed, and ways are suggested in which diffusion approaches can be modified and existing knowledge employed to meet short and long term goals of DOE. DOE

N80-14519# Midwest Research Inst., Golden, Colo. **IMPLEMENTATION OF STATE SOLAR INCENTIVES: LAND-USE PLANNING TO ENSURE SOLAR ACCESS**

P. Pollock Mar. 1979 41 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-51-163) Avail: NTIS HC A03/MF A01

State incentives in land use planning to ensure solar access are examined to determine issues in program design and implementation. These incentives include broad legislative grants of solar rights, application of nuisance law to solar collector shading, removal of restrictive covenants or establishment of covenants to protect solar access, provision for privately negotiated solar easements, and land use planning and regulation to include passive solar design and provision for active solar collection in land use development. Oregon is engaged in a statewide, mandated local comprehensive planning process which includes

consideration of energy conservation and renewable energy sources. California has two solar access related bills which address private solar easements, subdivision design, restrictive covenants, and shading by vegetation. New Mexico has a broad legislative grant of solar rights based on water rights law. Minnesota authorized the inclusion of solar energy as a factor in local land use planning and established a private easement procedure. DOE

N80-14520# Midwest Research Inst., Golden, Colo. **IMPLEMENTATION OF STATE SOLAR INCENTIVES: A PRELIMINARY ASSESSMENT**

J. Ashworth, B. Green, P. Pollock, R. Odland, R. Saltonstall, and L. J. Perelman Jan. 1979 238 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-51-159) Avail: NTIS HC A11/MF A01

The implementation of official state solar energy incentives programs was investigated. Questions of incentive design and program effectiveness are addressed in certain portions of the text, but the bulk of the research effort is directed toward examining how laws and legislative mandates have been transformed into rules, regulations, eligibility criteria, standards, comprehensive land use plans, grants, tax deductions, and demonstration projects. Most of the programs discussed will be official governmental actions, although the roles of private groups, advisory councils, and universities are addressed. Programs were examined in Arizona, California, Florida, Maine, Massachusetts, Minnesota, Montana, New Mexico, and Oregon. DOE

N80-14521# Department of Energy, Washington, D. C. **COMMERCIALIZATION STRATEGY REPORT FOR ENERGY FROM URBAN WASTES**

D. Walter, S. Levy, and C. Rines [1979] 48 p

(TID-28852-Draft) Avail: NTIS HC A03/MF A01

Three broad technologies are potentially available to recover energy and energy-intensive materials from urban wastes: mechanical, thermal, and biological. Worldwide experience indicates that commercialization is feasible although there are a number of technical, economic, and institutional barriers that currently limit the use of wastes. From a technical standpoint the daily variability of urban waste makes control and optimization of any process difficult. Further development and optimization of equipment is necessary to improve efficiency and reduce capital costs although there are no foreseen technological barriers and basic breakthroughs are not needed. Technical, market/economic, environmental, and institutional readiness and benefits analysis are discussed. The commercializations strategy is summarized. DOE

N80-14522# Brookhaven National Lab., Upton, N. Y. Energy and Environment Dept.

SOLID ELECTROLYTE FUEL CELL FOR ELECTRIC POWER GENERATION

S. Srinivasan and H. S. Isaacs 1979 10 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979

(Contract EY-76-C-02-0016)

(BNL-26238; CONF-790803-29)

Avail: NTIS

HC A02/MF A01

The development of high temperature fuel cells with molten carbonates or solid electrolytes are described. The advantages of solid electrolyte over the molten electrolyte fuel cells including: higher projected efficiencies; higher attainable current densities; and no cell corrosion problems are discussed. The design, fabrication, and testing of multicell stacks (5 cells) are discussed. The operating cell characteristics are examined in respect to meeting power plant performance goals. A.W.H.

N80-14523# Institute of Gas Technology, Chicago, Ill. **FUEL CELL OPTION**

K. F. Blurton Oct. 1978 13 p Presented at Conf. on Nat. Energy Econ. 2, Tulsa, Okla., 18-20 Sep. 1978

(Contract EM-78-C-03-1735)

(CONF-7809137-1) Avail: NTIS HC A02/MF A01

Fuel cell technology and its potential application is discussed. The strategy of fuel cell development is examined and the attributes of fuel cell power plants are described. DOE

N80-14524# Illinois Univ., Urbana. Center for Advanced Computation.

ENERGY CONSERVATION IN THE US ECONOMY FROM INCREASED RECYCLE OF OBSOLETE STEEL SCRAP Final Report

J. R. Brodrick Nov. 1978 110 p refs

(Contract EY-76-S-02-2893)

(COO-2893-10) Avail: NTIS HC A06/MF A01

Energy consumption in the steel industry is discussed and a recycling method is proposed for energy conservation. A model is presented to define the energy savings for the steel industry, the labor impact, and the economic factors of recycling scrap metal. A.W.H.

N80-14525# Argonne National Lab., Ill.

DEFINITION AND ANALYSIS OF THE BARRIERS TO THE IMPLEMENTATION OF URBAN ENERGY RECOVERY SYSTEMS

May 1979 22 p

(Contract W-31-109-eng-38)

(ANL/CNSV/TM-2) Avail: NTIS HC A02/MF A01

Major barriers to the implementation of urban energy recovery systems and the identification of Federal programs believed to be the most effective in developing these systems are presented. A survey of 40 persons experienced in the implementation of urban energy recovery systems, which provides the results, is analyzed. DOE

N80-14526# Los Alamos Scientific Lab., N. Mex.

APPLICATIONS OF FUEL CELLS IN TRANSPORTATION
B. McCormick, R. Bobbett, D. Lynn, S. Nelson (DOE, Washington, D.C.), S. Srinivasan (Brookhaven National Lab.), and J. McBreen (Brookhaven National Lab.) 1979 11 p Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5-10 Aug. 1979

(Contract W-7405-eng-36)

(LA-UR-79-628; CONF-790803-16)

Avail: NTIS

HC A02/MF A01

A detailed technical and economic evaluation of potential applications for fuel cells in transportation is given. Four vehicle types were evaluated: city bus, highway bus, delivery van, and consumer car, using fuel cell and reformer data. Various fuel options and performance vs economic tradeoffs were considered and final recommendations are presented. DOE

N80-14527# Sandia Labs., Albuquerque, N. Mex.

THERMAL AGING CHARACTERISTICS OF ELECTRODE-POSITED BLACK CHROME SOLAR COATINGS

R. B. Pettit and R. R. Sowell 1979 5 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract EY-76-C-04-0789)

(SAND-78-2094C; CONF-790541-32)

Avail: NTIS

HC A02/MF A01

By reducing the trivalent chromium concentration of Chromonyx black chrome plating bath, coatings with improved thermal stability characteristics were obtained. For trivalent chromium concentrations as low as 8 g/l, solar absorptance values decreased only a few percent from initial values of approximately 0.97 after heating in air at 400 C for over 3600 hours. Coating composition and structure were studied using transmission electron microscopy, scanning electron microscopy, and sputter Auger-profiling. Initial results indicate that the coatings from the nominal bath composition are composed of small particles, with diameters in the range 65 to 90 nm. When the trivalent chromium concentration is reduced, these particles agglomerate into larger clusters that are 150 to 250 nm in size. Upon heating in air, all coatings experience a substantial amount of oxidation, but the stable coatings maintain a significantly higher metallic chromium content. DOE

N80-14528# California Univ., Livermore. Lawrence Livermore Lab.

NON-TRACKING INFLATED CYLINDRICAL SOLAR CONCENTRATOR

J. W. Gerich 22 May 1979 18 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract W-7405-eng-48)

(UCRL-82721; CONF-790541-12)

Avail: NTIS

HC A02/MF A01

A concentrating solar collector able to produce pressurized hot water up to a temperature of 175 C was developed. The collector structure consists mainly of an inflated thin film plastic cylinder that is clear on the upper portion and is an aluminized reflector on the lower portion. The reflector concentrates sunlight on a receiver tube which is jacketed with a heat transfer suppressing, thin film plastic cylinder. The first experimental collectors verified performance modeling codes. The second generation collectors now being constructed address cost considerations and ease of fabrication, installation, and maintenance. It was found that the installed cost of the inflated concentrator is likely to be one-fifth that of parabolic trough concentrators. An experimental apparatus was developed to measure the total hemispherical emittance of full size receiver tubes. Test results indicate a rather dramatic increase in the room temperature value at typical concentrator operating temperatures. R.E.S.

N80-14529# California Univ., Livermore. Lawrence Livermore Lab.

LAWRENCE LIVERMORE LABORATORY GEOTHERMAL ENERGY PROGRAM: A STATUS REPORT ON THE DEVELOPMENT OF THE TOTAL-FLOW CONCEPT M.S. Thesis

A. L. Austin and A. W. Lundberg 2 Oct. 1978 77 p refs

(Contract W-7405-eng-48)

(UCRL-50046-77) Avail: NTIS HC A05/MF A01

The technology development activities of the Geothermal Energy Program at the Lawrence Livermore Laboratory are summarized. Significant progress toward development of the total-flow concept was made. The results show that the original goal of 70% engine efficiency for the total-flow impulse turbine is achievable; that a total-flow system is competitive economically with conventional systems; and that the total-flow concept offers the benefit of more efficient utilization of geothermal resources for electric power production. The evaluation of several liquid expanders designed for low-temperature (including geopressured) resources suggests that if development were continued, these expanders could be used in combination with conventional systems to increase overall system efficiency. DOE

N80-14530# Argonne National Lab., Ill.

LITHIUM/METAL SULFIDE BATTERY DEVELOPMENT

R. K. Steunenberg 1979 15 p refs Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wis., 21 May 1979

(Contract W-31-109-eng-38)

(CONF-790538-10) Avail: NTIS HC A02/MF A01

Lithium/metal sulfide batteries developed for electric vehicle propulsion and for stationary energy storage applications such as load leveling are described. The battery cells consist of lithium-aluminum or lithium-silicon negative electrodes, iron sulfide (FeS or FeS₂) positive electrodes, and molten LiCl-KCl electrolyte. The cells are enclosed in a thermally insulated jacket to maintain an operating temperature of 400 to 500 C. A 40 kWh electric vehicle battery consisting of 120 Li-Al/FeS cells is described. DOE

N80-14531# Argonne National Lab., Ill.

ADVANCED BATTERIES FOR ELECTRIC VEHICLES: A LOOK AT THE FUTURE

William J. Walsh 23 Apr. 1979 23 p refs Presented at the APS Meeting, Washington, D.C., 23 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790484-1) Avail: NTIS HC A02/MF A01

Battery systems which are potential candidates for electric motor vehicles are discussed. These include lead acid, nickel-iron, nickel-zinc, zinc-chlorine, lithium-metal sulfide and sodium-sulfur (ceramic electrolyte). The characteristics of these batteries are discussed. Each individual battery system is found to have less than 50% probability of successful development and commercialization; however, the cumulative probability that at least one of the batteries would be successfully developed is judged to be greater than 75%. It is predicted that the magnitude of

the market penetration of electric motor vehicles will depend on the severity of future liquid-fuel shortages along with the cost and quality of the advanced batteries. DOE

N80-14532# Sandia Labs., Livermore, Calif.
DISSOCIATION PRESSURE MEASUREMENTS ON SALTS PROPOSED FOR THERMOCHEMICAL ENERGY STORAGE

Robert W. Carling Jul. 1979 40 p refs
 (Contract EY-76-C-04-0789)
 (SAND-79-8033) Avail: NTIS HC A03/MF A01

Chemical heat pumps employ salt hydrates, ammoniates, or methanolates for energy storage. The efficient operation of a chemical heat pump depends strongly upon the reaction energies and pressure/temperature relationships of these salts. An apparatus was assembled to measure pressure/temperature relationships and derive reaction energies. A sensitive cantilever balance used to prepare salt samples in situ so that the stoichiometry of the salt hydrate, ammoniate, or methanolate is known prior to the pressure measurements is incorporated in this apparatus. The apparatus is described and results on two systems are presented: $MgCl_2 \cdot nH_2O$ (where $n = 6.1, 6, \text{ or } 4$) and $CaCl_2 \cdot nNH_3$ (where $n = 8, 4, 2, \text{ or } 1$). DOE

N80-14533# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.

PROCEEDINGS OF THE THERMAL ENERGY STORAGE IN AQUIFERS WORKSHOP

Dec. 1978 134 p refs Conf. held at Berkeley, Calif., 10-12 May 1978

(Contract W-7405-eng-48)

(LBL-8431; CONF-7805140) Avail: NTIS HC A07/MF A01

Contents: thermal energy storage in aquifer workshop; seasonal storage--prospects and problems; hydrogeology and reservoir engineering; energy management objectives and economics of heat storage wells; institutional aspects of utilizing heat storage in aquifers--a proposal for a prototype test; environmental aspects of low temperature thermal energy storage in aquifers; mathematical modeling of thermal energy storage in aquifers; confined aquifer experiment; thermal storage of cold water in ground water aquifers for cooling purposes; air conditioning Kennedy Airport with winter cold; high temperature underground thermal energy storage. R.E.S.

N80-14534# Battelle Pacific Northwest Labs., Richland, Wash.
COMPRESSED AIR ENERGY STORAGE TECHNOLOGY PROGRAM Annual Report, 1978

W. V. Loscutoff Jun. 1979 180 p refs

(Contract EY-76-C-06-1830)

(PNL-2935) Avail: NTIS HC A09/MF A01

Results of studies performed to establish design and stability criteria for compressed air energy storage (CAES) underground reservoirs are presented along with advanced concepts that will eliminate dependence of the CAES concept on petroleum fuels. Reservoirs examined include aquifers, hard rock caverns, and salt caverns. Equipment evaluation and development studies are cited together with feasibility studies of alternative fuels and technologies such as adiabatic systems, hybrid systems utilizing thermal energy storage and fuel, coal fired fluidized processes, and coal fired low Btu gasifiers. J.M.S.

N80-14535# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE FOR ELECTRIC POWER SYSTEM DYNAMIC STABILIZATION

Robert Turner 1979 7 p refs Presented at Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979

(Contract W-7405-eng-36)

(LA-UR-79-1220; CONF-790803-07)

Avail: NTIS

HC A02/MF A01

A superconducting magnetic energy storage (SMES) system developed for a dynamic stabilizer to be installed in the Bonneville Power Administration (BPA) power system at Tacoma, Washington, by 1982 is described. This unit is an alternate stabilization method to the dc modulator now used to stabilize the 900 mile, ac intertie between BPA and Southern California. The SMES unit consists of a 30 MJ solenoid, a 10 MW convertor, a liquid helium dewar and auxiliary systems. The SMS dynamic

stabilizer design is presented with status information about the superconducting coil, the converter, and other components of the SMES dynamic stabilizer summarized. DOE

N80-14536# Elliott Co., Jeannette, Pa.
PRELIMINARY DESIGN OF AXIAL FLOW HYDROCARBON TURBINE/GENERATOR SET FOR GEOTHERMAL APPLICATIONS Final Report

N. A. Samurin and J. R. Shields May 1979 179 p refs
 Sponsored by Elec. Power Res. Inst.

(EPRI-ER-513) Avail: NTIS HC A09/MF A01

The design of a 65 MW (e) gross turbine generator set in which a hydrocarbon gas mixture is used as the motive fluid is outlined. The turbine generator set is part of a geothermal binary cycle electric power plant proposed for the Heber site in the Imperial Valley, California. Aerodynamic design considerations and estimated unit performance for three hydrocarbon gas mixtures are presented. Real gas properties and equations of state are reviewed as they affect the turbine design and the thermodynamic cycle. The mechanical designs for the casing, rotor dynamics, shaft sealing and unit construction are detailed. Support systems such as the lube and seal supply system, turbine controls, etc., are reviewed. An extensive hydrocarbon turbine general specification is also included. DOE

N80-14537# Southern California Edison Co., Rosemead.
COMMERCIAL SOLAR AUGMENTED HEAT PUMP SYSTEM

J. Wilborn Mar. 1979 79 p refs Sponsored by Elec. Power Res. Inst.

(EPRI-ER-1004) Avail: NTIS HC A05/MF A01

A solar energy augmented water source heat pump system was installed on an administration building located on the campus of the Golden West College in Huntington Beach, California. Testing began in mid-1978 and will continue for two years. Solar energy is collected from 600 square feet of solar collector panels mounted on the administration building roof. Buried tanks having a total capacity of 4,000 gallons store thermal energy. A complete and automated operation control system and instrumentation package are included. The system features flexible operation and operates in multiple modes. These modes of operation allow testing with and without solar collectors and with and without thermal storage. Solar augmentation, thermal storage, and heat pumps are to be evaluated. DOE

N80-14538# Sandia Labs., Albuquerque, N. Mex.
DARRIEUS WIND TURBINE PROGRAM AT SANDIA LABORATORIES

P. C. Klimas 1979 12 p refs Presented at Wind Energy Innovative Sys. Conf., Colorado Springs, 23 May 1979

(Contract EY-76-C-04-0789)

(SAND-79-0997C; CONF-790501-2)

Avail: NTIS

HC A02/MF A01

The design and development of vertical axis wind turbines (VAWTs) are discussed. Aerodynamic, structural, testing, and systems analyses capabilities for the development program are reported. The aerodynamic and structural characteristics of the VAWT are presented. A.W.H.

N80-14539# PRC Energy Analysis Co., McLean, Va.
ENGINEERING CONCERNS IN SOLAR SYSTEM DESIGN AND OPERATION

James L. Easterly Mar. 1979 24 p refs

(Contract EG-77-C-01-2522)

(SOLAR/0811-79/01) Avail: NTIS HC A02/MF A01

Engineering concerns associated with the startup and operation of solar heating and cooling installations are discussed. Recommendations are also made regarding the design and installation phases to help in avoiding these problems. DOE

N80-14540# Mound Lab., Miamisburg, Ohio.
STUDIES OF DIRECTLY ABSORBING FLUIDS FOR MID-TEMPERATURE SOLAR THERMAL APPLICATIONS

A. R. Burke, D. E. Etter, C. J. Wiedenheft, and L. J. Wittenberg 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract EY-76-C-04-0053)
(MLM-2625-OP; CONF-790541-17) Avail: NTIS
HC A02/MF A01

Thermal, photochemical, and optical absorptivity studies at elevated temperatures on various heat transfer fluids containing chromophoric materials are discussed. The solar absorption efficiency of the fluids and chromophores were calculated at ambient and elevated temperatures. Density, viscosity, and heat capacity measurements for specific solutions were determined. Eight chromophoric solutions are identified as candidates for directly absorbing fluids for use up to 300 C. DOE

N80-14541# Mound Lab., Miamisburg, Ohio.
CONSTRUCTION AND INITIAL OPERATION OF THE MIAMISBURG SALT-GRADIENT SOLAR POND

R. S. Bryant, R. P. Bowser, and L. J. Wittenberg 1979 5 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract EY-76-C-04-0053)
(MLM-2626-OP; CONF-790541-16) Avail: NTIS
HC A02/MF A01

The largest salt-gradient solar pond in the U.S. occupies an area of 2020 sq mi in Ohio and was installed for only \$35/sq mi. A technique was successfully demonstrated for the formation of the gradient zone, approximately 1 m thick, in which fresh water was injected horizontally below the surface of the concentrated salt solution. Without any useful heat removed, the storage layer water, approximately 18.5% NaCl, reached a peak temperature of 51.1 C in October 1978 and a minimum temperature of 28.4 C during February 1979. The pond is predicted to deliver 281,000 kW hr/yr to be used principally for heating an outdoor swimming pool in the summer and a recreation building from October to December. The projected heat cost is 2.5 cents/kW hr, based upon amortization of 10%/yr. DOE

N80-14542# Department of Energy, Washington, D. C.
GEOTHERMAL ENERGY: PROGRAM SUMMARY

Jun. 1979 316 p refs
(DOE/ET-0101) Avail: NTIS HC A14/MF A01

Descriptions of geothermal projects for the fiscal year 1978 are presented. Each summary gives the project title, contractor name, contract number, funding level, dates, location, and name of the principal investigator. Objectives and strategies for each program are provided. DOE

N80-14543# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR SMALL WIND SYSTEMS

Louis V. Divone, R. Blaunstein, J. Gros, A. K. Ingberman, W. L. R. Rice, and S. J. Taylor [1979] 46 p refs
(TID-28844-Draft) Avail: NTIS HC A03/MF A01

The commercial readiness of small wind systems is addressed. Barriers to be overcome before this technology is ready to be used commercially are cited and possible actions that might be considered to remove specific barriers are identified. The full implications of the various proposed actions have not been fully developed and many actions listed undoubtedly have substantial problems associated with them. DOE

N80-14544# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR LARGE WIND SYSTEMS

Louis V. Divone, R. Blaunstein, J. Gros, A. K. Ingberman, W. L. R. Rice, and S. J. Taylor [1979] 41 p
(TID-28843-Draft) Avail: NTIS HC A03/MF A01

The commercialization of wind turbines is analyzed concerning technical readiness; market and economic aspects; environmental impacts; institutional acceptance; benefit analysis; and commercialization development strategy. DOE

N80-14545# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR SOLAR WATER HEATING

Frederick H. Morse and J. M. Davis [1979] 35 p refs
(TID-28856-Draft) Avail: NTIS HC A03/MF A01

The commercial readiness of solar hot water heating is discussed. Some barriers to be overcome before this technology is ready to be used commercially are identified. Also identified are possible actions that might be considered to remove specific barriers. Technical, market/economics, environmental, and institutional readiness, and benefits analysis are discussed. DOE

N80-14546# Midwest Research Inst., Golden, Colo.
THERMAL ENERGY STORAGE FOR SOLAR APPLICATIONS: AN OVERVIEW

Charles Wyman Mar. 1979 123 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-34-089) Avail: NTIS HC A06/MF A01

The economic role of storage for solar home heating and stand-alone electric plants are examined. Factors which affect the economics of storage are discussed. The costs and storage capacities of representative sensible and latent heat storage materials are summarized. Various modes of operation are also presented for thermal storage by reversible chemical reactions. Containers and heat exchangers are reviewed to illustrate possible approaches to reducing storage costs. Reversible reaction storage, and gas-solid reactions are shown to have desirable attributes for solar energy storage. DOE

N80-14547# Midwest Research Inst., Golden, Colo.
A REVIEW OF THE ECONOMICS OF SELECTED PASSIVE AND HYBRID SYSTEMS

Deborah L. Buchanan Jan. 1979 27 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-61-144) Avail: NTIS HC A03/MF A01

Performance and economic information on passive and hybrid systems were compiled as part of solar commercial readiness activities. The results of selected performance simulation and cost estimate studies are presented as well as actual cost and performance data from operating buildings. Systems representative of each major passive design concept are included: direct gain, indirect gain (thermal storage wall, thermal storage roof), and isolated gain (convective loop/thermosiphon, attached sunspace/greenhouse). Results are presented in tables structured by major design concept. Data for simulated and actual systems are presented separately. Comparison of individual system design specifications, performance, incremental solar cost, and cost of delivered energy are made by major design concept and by simulated or actual data source. In addition, results are aggregated to derive cost and performance ranges over all data sources, by design concept and by simulated or actual system. DOE

N80-14548# Midwest Research Inst., Golden, Colo.
COMMERCIALIZING SOLAR ARCHITECTURE

Gregory Franta Mar. 1979 38 p refs Presented at SERI Architectural Planning Seminar, Golden, Colo., 10 Jul. 1978
(Contract EG-77-C-01-4042)
(SERI/TP-62-113; CONF-780792) Avail: NTIS
HC A03/MF A01

Barriers to solar technology commercialization through architecture are considered. Attitudes of architects, their clients, government officials, and design/construction professionals are discussed along with technical issues related to the environment, building design and construction, operation, and maintenance. Performance evaluation of solar heating and cooling of buildings (SHACOB) and the general lack of technical awareness by architects regarding non-SHACOB technologies (wind, biomass, process heat, and photovoltaic cells) are included. Institutional issues related to law and government and the solar infrastructure are identified as important. Suggestions related to information, development, acquisition, and dissemination, education and training, demonstrations and design competitions, and other actions aimed at integration of solar technology into the total energy-conscious design process are given. J.M.S.

N80-14549# California Univ., Berkeley. Lawrence Berkeley Lab.

THERMAL DEGRADATION OF A BLACK CHROME SOLAR SELECTIVE ABSORBER COATING: SHORT TERM

Carl M. Lampert May 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract W-7405-eng-48)
(LBL-8857; CONF-790541-37) Avail: NTIS
HC A02/MF A01

The energy absorption properties and chemical microstructure of Chrom Onyx were investigated using electron microscopy and X-ray diffraction techniques. Different temperatures for short annealing times were used to evaluate the coating's temperature resistance limitations, along with possible degradation mechanisms for various stagnation situations. Samples were tested in both air and vacuum. It is concluded that for all practical considerations, black chrome optically degrades between 500 - 600 C during short exposure times. M.G.

**N80-14550# Aerospace Corp., El Segundo, Calif.
THE 10 MW SOLAR THERMAL PILOT PLANT DYNAMIC
SIMULATION. VOLUME 1: COMPUTER PROGRAM
DESCRIPTION**

1 Dec. 1978 154 p refs 2 Vol.
(Contract ET-78-C-03-2028)
(ATR-78(7747)-1-Vol-1) Avail: NTIS HC A08/MF A01

A digital computer simulation of a prototype solar 10 MW (electric) pilot power plant near Barstow, California is presented. The simulation program has been designated STMPSS (Solar Ten Megawatt Pilot Plant Simulation). This simulation is operative on the Control Data Corporation (CDC) 7600 digital computer, with use of the CDC SCOPE 2.1 operating system. Logic and analytical details on which the program is based are described.

DOE

**N80-14551# Aerospace Corp., El Segundo, Calif.
THE 10 MW SOLAR THERMAL PILOT PLANT DYNAMIC
SIMULATION. VOLUME 2: COMPUTER PROGRAM
SOURCE LISTING**

1 Dec. 1978 271 p 2 Vol.
(Contract ET-78-C-03-2028)
(ATR-78(7747)-2-Vol-2) Avail: NTIS HC A12/MF A01

The actual computer source listing of program STMPSS is presented. All routines specifically developed to simulate the solar thermal pilot plant are included. The listing contains a generous amount of nonprogrammatic comment lines to aid in interpretation of program logic. DOE

**N80-14552# Brookhaven National Lab., Upton, N. Y.
EVALUATION OF PERFORMANCE ENHANCEMENT OF
SOLAR POWERED ABSORPTION CHILLER WITH AN
IMPROVED CONTROL STRATEGY USING THE BNL-BUILT
HARDWARE SIMULATOR**

P. C. Auh 1979 5 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
(Contract EY-76-C-02-0016)
(BNL-26218; CONF-790541-21) Avail: NTIS
HC A02/MF A01

Transient and cycling performance characteristics of an advanced, solar absorption chiller were investigated. The results of the various combinations of on/off cycling runs showed that the net capacity loss during the start-up transient period could be significantly reduced when the residual cooling capacity generated during the off-period is compensated to the initial loss. Furthermore, the experimental investigation showed that the performance degradation, due to inherent transient behavior of a chiller, could be significantly improved by a simple control modification. The degree of performance under the modified control mode, as a function of the cycle period and such effects on the integrated chiller performance, were investigated. Under the modified control mode, the need of a large cold-side storage may no longer exist. This may offer significant economical advantages, especially for small residential cooling systems, without sacrifice in their performances. DOE

**N80-14553# Miami Univ., Coral Gables, Fla. Clean Energy
Research Inst.
FIFTH OCEAN THERMAL ENERGY CONVERSION CONFER-
ENCE, VOLUME 2, SECTIONS 4-5**

A. Lavi, ed. and T. N. Veziroglu, ed. Sep. 1978 592 p refs
Conf. held at Miami Beach, Fla., 20-22 Feb. 1978
(Grant EG-77-G-05-5550)
(CONF-780236-P2) Avail: NTIS HC A25/MF A01

Contents: ocean thermal energy conversion (OTEC) platform design optimization; considerations in selection of OTEC platform size and configuration; OTEC-1 early ocean test project; preliminary engineering design of an OTEC pilot plant; operational sea state and design wave criteria; OTEC platform station keeping analysis; OTEC cold water pipe design loads; dynamic loads induced by severe storms in elastic cold water pipes attached to OTEC ships by fixed and hinged connections; conceptual design of an OTEC power system using modular heat exchangers; power system module configuration using aluminum heat exchangers. R.E.S.

N80-14557# Sandia Labs., Albuquerque, N. Mex.

HELIOS AND RECONCENTRATORS

C. N. Vittitoe, F. Biggs, L. K. Matthews, and L. O. Seamons 1979 6 p refs Presented at Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979

(Contract EY-76-C-04-0789)
(SAND-78-1600C; CONF-790541-18) Avail: NTIS
HC A02/MF A01

The HELIOS computer code for modeling solar energy collection by reflecting systems is discussed. Extensions to HELIOS which include application to reconcentrators and to the evaluation of heliostats are described. The comparison of HELIOS predictions with image data produced by 23 heliostats and with data from a single facet, chosen partially because of exceptionally large distortion, is discussed. The method of treating reconcentrators is presented. DOE

N80-14558# Sandia Labs., Livermore, Calif.

**SYSTEMS STUDIES FOR CENTRAL SOLAR THERMAL
ELECTRIC**

Oct. 1978 492 p refs Workshop held at Houston, Tex., 27-30 Mar. 1978

(Contracts EY-76-C-04-0789; AT(29-1)-789)
(CONF-780383) Avail: NTIS HC A21/MF A01

Twenty-one articles are presented which focus on the current technical and economic status of central receiver solar thermal electric systems and future program direction. The planning and operational differences which the electric utilities foresee solar electric will encounter are discussed. Methodologies associated with utility network planning and operation are presented. National energy models are discussed along with their implications with respect to the future of various solar electric options. R.E.S.

N80-14559# InterTechnology Corp., Warrenton, Va.

**PHOTOVOLTAIC POWER SYSTEMS MARKET IDENTIFICA-
TION AND ANALYSIS Final Report, Jan. 1977 - Feb. 1978**

May 1979 551 p refs
(Contract EG-77-C-01-4022)
(HCP/T4022-01) Avail: NTIS HC A23/MF A01

The marketing of near and intermediate term photovoltaic power applications was analyzed. The current uses of photovoltaic systems, both domestic and international, were surveyed and the usage of those systems was projected into the future. Products were defined and a market survey was carried out. A detailed scenario which forecasts sales, barriers to market acceptance, and technological innovations required for proper introduction of the products was developed. DOE

N80-14560# Electric Power Research Inst., Palo Alto, Calif.

ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES, 1978

W. L. York May 1979 197 p
(EPRI-ER-966-SR) Avail: NTIS HC A09/MF A01

The scope of solar energy projects sponsored by electric utilities in the United States is presented. Brief descriptions of 600 projects being conducted by 165 utility companies are given. Also included are a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, a list of utilities organized by states, and a list of available reports on utility-sponsored projects. DOE

**N80-14561# Department of Energy, Washington, D. C. Div.
of Solar Applications Developments.**

PHOTOVOLTAIC INCENTIVES OPTIONS

R. M. Terry Aug. 1978 227 p
(HCP/CS-0023) Avail: NTIS HC A11/MF A01

The options available to the Federal Government to encourage adequate growth of the solar photovoltaic industry are identified. Appropriate incentives, strategies and options (combinations of strategies) were identified by defining the policy objectives to be achieved by promoting the growth of the photovoltaic industry. Policy objectives, defined by interpreting: (1) general policy statements on energy policy and on the commercialization of new energy technologies; (2) general and specific policy statements on solar energy and on photovoltaics; and (3) specific photovoltaic program goals, are discussed. The definitions of policy objectives derived from these sources were treated as assumptions for the purpose of this study. A determination of the steps for the attainment of policy objectives is presented. DOE

N80-14562# Argonne National Lab., Ill.
OVERVIEW OF THE DEPARTMENT OF ENERGY'S RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM FOR THE RECOVERY OF ENERGY AND MATERIALS FROM URBAN WASTE

Alan S. Cohen 1979 15 p refs Presented at the US EPA Res. Symp. on Res. on Gas and Leachate and Landfills and Resource Recovery, Orlando, Fla., Mar. 1979 (Contract W-31-109-eng-38)
(CONF-790373-1) Avail: NTIS HC A02/MF A01

Technological options available for reprocessing waste into fuels, metals, glass, paper, ammonia, glucose, fertilizer, and other energy-intensive products are discussed with emphasis on some of the approximate 80 projects comprising the Urban Waste Technology Branch's R, D, and D program. Projects are grouped as being primarily related to mechanical, thermal, or biological processes. To date, the majority of R and D funding is devoted to biological processes including anaerobic and enzymatic digestion, energy production and conservation in water and waste water treatment, and energy generation and recovery in sanitary landfills. However, demonstration activities, representing slightly less than half the program effort, are focused on the thermal/mechanical systems. If successful, approximately 3% of the nation's energy needs could be supplied by reprocessing wastes. DOE

N80-14563# Energy Technology Engineering Center, Canoga Park, Calif.

OTEC-1 TEST CONDUCTOR PROGRAM
P. Archbold and J. O. Bates 1978 13 p Presented at Seminar on Testing Solar Energy Mater. and Systems, Washington, D.C., 22 May 1978
(Contract EY-76-C-03-0700)
(CONF-780550-9) Avail: NTIS HC A02/MF A01

The involvement of the test director contractor (TDC) in the OTEC-1 test program is outlined. The preparation for and testing of the initial test heat exchangers and auxiliary equipment are considered. Interfaces, TDC/SIC (Systems Integration Contractor) test relationship, test request, test procedures, data handling, and biofouling laboratory are discussed. DOE

N80-14565# Sandia Labs., Albuquerque, N. Mex.
HAZARDOUS PROPERTIES AND ENVIRONMENTAL EFFECTS OF MATERIALS USED IN SOLAR HEATING AND COOLING (SHAC) TECHNOLOGIES: INTERIM HANDBOOK

J. Q. Searcy Dec. 1978 225 p refs
(DOE/EV-0028) Avail: NTIS HC A11/MF A01

General background information related to SHAC systems and codes and standards are given. Materials are categorized according to their functional use in SHAC systems as follows: (1) heat transfer fluids and fluid treatment chemicals; (2) insulation materials; (3) seals and sealant materials; (4) glazing materials; (5) collector materials; and (6) storage media. The information presented includes general properties, chemical composition, thermal degradation products, and thermoxidative products of some commercial materials. Toxic properties and other potential health effects, fire hazard properties, and environmental effects of and disposal methods for SHAC materials are also presented. DOE

N80-14566# PRC Energy Analysis Co., McLean, Va.
SYSTEM TESTS AND APPLICATIONS PHOTOVOLTAIC PROGRAM

May 1979 336 p refs
(Contract EG-77-C-01-4024)
(HCF/T4024-01/15) Avail: NTIS HC A15/MF A01

Progress in developing photovoltaic solar energy conversion systems to reduce dependence on fossil fuels is summarized. Exhibits designed to acquaint the general public to photovoltaics are included along with component field tests conducted to monitor module reliability under actual environmental conditions. Major test facilities are described. DOE

N80-14567# Department of Energy, Washington, D. C.
ENERGY POLICY AND CONSERVATION ACT (PUBLIC LAW 94-163) AS AMENDED BY THE NATIONAL ENERGY CONSERVATION POLICY ACT (PUBLIC LAW 95-619). TITLE 10: ENERGY. CHAPTER 2: DEPARTMENT OF ENERGY. SUBCHAPTER D: ENERGY CONSERVATION. PART 430: ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

1979 19 p
(DOE/CS-0056) Avail: NTIS HC A02/MF A01

The text of Part B, Energy Conservation Program for Consumer Products Other Than Automobiles, from Energy Policy and Conservation Act as amended by National Energy Conservation Policy Act (PL-619) is presented. The text includes the following subjects: coverage, test procedures, labeling, energy efficiency standards, requirements of manufacturers, effect on other law, rules, authority to obtain information, exports, imports, prohibited acts, enforcement, injunctive enforcement, citizen suits, administrative procedure and judicial review, consumer education, annual report, and authorization of appropriations. DOE

N80-14568# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

PERFORMANCE OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM WITH FLAT-PLATE AND EVACUATED TUBULAR COLLECTORS: CSU SOLAR HOUSE 1

W. S. Duff, T. M. Conway, G. O. G. Loef, D. B. Meredith, and R. B. Pratt 1978 8 p refs Presented at Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978 (Contract EY-76-S-02-2577)
(COO-2577-16; CONF-780808-24) Avail: NTIS HC A02/MF A01

Measurements in Solar House One at Colorado State University provided comparison data on space heating, water heating, and cooling by systems in which flat plate collectors and evacuated tube collectors were used. Data were procured on 47 days during operation of the flat plate collector and on 112 days when the house was heated or cooled by the evacuated tube collector system. It is concluded that the system comprising an evacuated tubular collector, lithium bromide absorption water chiller, and associated equipment is highly effective in providing solar heating and cooling to a small building, that it can supply up to twice the space heating and several times the cooling obtainable from an equal occupied area of good quality flat-plate collectors, and that a greater fraction of the domestic hot water can be obtained by supplying its heat from main storage. DOE

N80-14569# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

REALISTIC SIZING OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEMS

D. S. Ward 1978 10 p refs Presented at Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978
(Contract EY-76-S-02-2858)
(COO-2858-14; CONF-780808-23) Avail: NTIS HC A02/MF A01

The accuracy of technical and economic sizing methods for solar heating and cooling systems in specific installations is demonstrated to be strongly dependent upon the accuracy of the input data. Variations in the solar radiation data due to the inherent errors in previous solar measurements, and the difficulty in calculating heating and cooling loads to a desired level of accuracy are shown to result in calculated fractions of the load, f, of values with 10 to 15% errors. For specific installations where the heating load was calculated (and not measured experimentally), the fraction of the load carried by solar could therefore, be calculated to only one significant figure. Similarly,

the inability to accurately predict inflation rates and certain other costs of the life cycle of a solar system, in addition to errors in the calculated heating load and fraction of the load, f, were shown to reduce the accuracy of economic costs of a solar system to values of + or - 25%. DOE

N80-14570# Mound Lab., Miamisburg, Ohio.
EVALUATION OF FUEL RESOURCES AND REQUIREMENTS FOR THE MAGNETIC FUSION ENERGY PROGRAM

T. B. Rhinehammer and L. J. Wittenberg 31 Oct. 1978 106 p refs

(Contract EY-76-C-04-0053)

(MLM-2419) Avail: NTIS HC A06/MF A01

The potential tritium requirements in the presently formulated development plan were assessed and possible sources for the required tritium were identified. The availability of lithium was surveyed also because the only practical production method for tritium is the neutron irradiation of lithium. The estimates of world-wide resources of lithium available to supply such an industry are reviewed. Additionally, the isotopic separation techniques for lithium-6 enrichment are discussed. The resources and requirements for mercury are included because of its potential use in a lithium isotopic separation technique. The availability of helium-3 and helium-4 is briefly discussed. R.E.S.

N80-14571# California Univ., Livermore. Lawrence Livermore Lab.

PROCESS DESIGN AND ECONOMIC ANALYSIS OF THE ZINC SELENIDE THERMOCHEMICAL HYDROGEN CYCLE

H. H. Otsuki and O. H. Krikorian 6 Sep. 1978 35 p refs

(Contract W-7405-eng-48)

(UCRL-52546) Avail: NTIS HC A03/MF A01

A detailed preliminary design for a hydrogen production plant was developed based on an improved version of the ZnSe thermochemical cycle for decomposing water. In the latest version of the cycle, ZnCl₂ is converted directly to ZnO through high temperature steam hydrolysis. This eliminates the need for first converting ZnCl₂ to ZnSO₄ and also slightly reduces the overall heat requirement. The ZnSe cycle is driven by a very high temperature nuclear reactor (VHTR) that provides a high temperature (1283 K) helium working gas for process heat and power. The plant is sized to produce 27.3 Mg/Hs/h and requires specially designed equipment to perform the critical reaction steps in the cycle. Conceptual designs were developed for several of the important process steps to make cost estimates. A cycle efficiency of about 40% and a hydrogen production cost of about \$14/GJ were obtained. DOE

N80-14572# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PROCEEDINGS OF THE DOE CHEMICAL/HYDROGEN ENERGY CONTRACTOR REVIEW SYSTEMS

Aug. 1978 380 p refs Presented at DOE Ann. Chem. Energy Storage and Hydrogen Energy System Contracts Rev., Baltimore, 16 Nov., 1977

(Contract EC-77-A-31-1035)

(CONF-771131) Avail: NTIS HC A17/MF A01

Chemical/hydrogen energy system contracts were reviewed. The review served as an effective means to (1) give all contractors an insight into the background and objectives of thirty-nine hydrogen-related tasks, (2) show the status of the studies or technical effort, (3) relate any problems that had impeded the progress, and (4) state projected solutions for resolving the identified problems. DOE

N80-14573# Argonne National Lab., Ill.
REVIEW OF INDUSTRIAL PARTICIPATION ON THE ANL LITHIUM/IRON SULFIDE BATTERY DEVELOPMENT PROGRAM

E. C. Gay, W. E. Miller, and R. F. Malecha 1978 30 p refs Presented at 13th IECEC Conf. of the Soc. of Automotive Engr., Detroit, 20-25 Aug. 1978

(Contract W-31-109-eng-38)

(CONF-780852-1) Avail: NTIS HC A03/MF A01

The development and fabrication of industrial cells is reviewed. Industrial cells that contained FeS₂ in the positive

electrode achieved a specific energy of 100 Wh/kg at a 4 hr discharge rate and a peak power of 100 W/kg. Some of these cells showed good performance for up to 300 deep discharge cycles. Industrial cells that contained FeS in the positive electrode maintained good performance through 1000 deep discharge cycles. Present cell development efforts are directed toward improving specific energy and power in the cells that contain FeS and improving cycle life in cells that contain FeS₂. DOE

N80-14574# Solar Energy Information Services, San Mateo, Calif.

ENGINEERS GUIDE TO SOLAR ENERGY

Yvonne Howell and Justin A. Bereny Feb. 1979 328 p

(PB-297043/2; SEIS-79/1; ISBN-0-930978-04-8;

LC-78-62956)

Copyright.

Avail:

NTIS

HC \$28.00/MF \$28.00 CSDL 13A

Information on solar heating technology is presented. The following subjects are covered: (1) an overview of the six basic solar technologies; (2) a comprehensive discussion of the solar resource, including a compendium of worldwide solar radiation data; (3) an introduction to passive solar technology; (4) extensive discussion of active solar systems, including applications for heating swimming pools, domestic hot water, and space heating; (5) methodology for calculating building heat loss and gain, including worldwide design temperature data; (6) an introduction to solar systems sizing through utilization of the f-chart method, including examples and worksheets; (7) a solar heating product directory divided into four sections: collectors, controls, pumps, and storage. GRA

N80-14575# General Accounting Office, Washington, D. C. Energy and Minerals Div.

COMMERCIALIZING SOLAR HEATING: A NATIONAL STRATEGY NEEDED Report to the Congress

20 Jul. 1979 86 p refs

(PB-297882/3; EMD-79-19) Avail: NTIS HC A05/MF A01 CSDL 13A

The adequacy of the Nation's efforts to commercialize solar heating systems is discussed. Constraints facing the use of solar heating systems, the effectiveness of ongoing efforts to overcome these constraints, and the potential effectiveness of the National Energy Act in encouraging the use of solar heating systems are covered. GRA

N80-14576# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.

WAVE POWER SYSTEMS

Norman Doelling 1 Jul. 1979 33 p refs

(PB-299851/6; MITSG-79/16; NOAA-79080910;

Opportunity-Brief-15) Avail: NTIS HC A03/MF A01 CSDL 10A

Ocean wave power was investigated as a usable, renewable, alternative energy source. The results suggest that both Salter cams and Cockerell rafts can be designed to convert wave motion to relative mechanical motion and mechanical forces. Mooring problems and costs suggest that Salter cams will be much more expensive than Cockerell rafts. A major problem is converting the available mechanical power to a more useful form, i.e., hydraulic or electric power. Upper limits on the amount of power that can be extracted from waves were investigated along with lower cost bounds. GRA

N80-14577# Ohio State Univ., Columbus. Solar Energy Lab.
OHIO EXPOSITION CENTER SOLAR HOME PROJECT Final Progress Report

R. V. DeVore, P. D. McWane, and D. L. Wineland 15 Jun. 1979 186 p refs

(PB-298541/4; OSU-SEL-5-510X)

Avail:

NTIS

HC A09/MF A01 CSDL 13A

The operation of an active liquid-based 615 square foot solar collector array installed on a 2200 square foot residence is reported. Data are presented for the four solar energy utilization subsystems: domestic hot water, direct solar heating, LiBr water absorption air conditioner, and solar-assisted heat pump. Daily insolation records are included for a one year period. GRA

N80-14578# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN. ECONOMIC EVALUATION MODEL FOR DIRECT USE OF MODERATE TEMPERATURE, UP TO 250 F. GEOTHERMAL RESOURCES IN THE NORTHERN ATLANTIC COASTAL PLAIN

Richard Weissbrod (Johns Hopkins Univ., Baltimore, Md.), William Barron (Johns Hopkins Univ., Baltimore, Md.), Peter Kroll (Johns Hopkins Univ., Baltimore, Md.), and William J. Toth Jun. 1979 71 p refs

(Contract EX-76-A-36-1008)

(PB-298785/7; APL/JHU/GEMS-003; APL/JHU/QM-79-002)

Avail: NTIS HC A04/MF A01 CSCL 13A

The Geothermal Resource Economic Evaluation System developed to calculate the average cost per million Btu of geothermal energy that is delivered either to residential and commercial users through a community heating system or to industrial process heat users is examined. The basic assumptions and the methods used in the model are presented. Results of the current studies indicate that, under a number of market conditions, i.e., for high-density residential housing or for large industrial users, and for a large range of resource conditions, geothermal energy costs are well below the costs of electrical space heating. GRA

N80-14584# Los Alamos Scientific Lab., N. Mex.

ENVIRONMENTAL OPTIONS FOR COAL USE

J. R. Bartlit 1979 13 p refs Presented at Energy and Environ. Technol. Training Conf., Tsailie, Ariz., 29 May 1979

(Contract W-7405-eng-36)

(LA-UR-79-1393; CONF-790550-1)

Avail: NTIS

HC A02/MF A01

The options for coal development are described and their environmental impacts discussed. The various options for better or worse air pollution controls are discussed including the legal options available for requiring the better (cleaner) levels of control if those are desired. DOE

N80-14587# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.

FUNDAMENTAL AND SEMI-GLOBAL KINETIC MECHANISMS OF HYDROCARBON COMBUSTION Annual Report, 1 Oct. 1977 - 30 Sep. 1978

F. L. Dryer and I. Glassman 1 Dec. 1978 30 p refs

(Contract EC-77-S-02-4372)

(COO-4272-3) Avail: NTIS HC A03/MF A01

The development of simplified chemical kinetic models to represent combustion chemistry is discussed. Studies of paraffin, olefin, and alcohol hydrocarbons are reviewed. Appropriate global models are presented and compared with experimental data. The results clearly demonstrate that the turbulent flow reactor facility can be used to develop accurate global models for a variety of important fuels. DOE

N80-14590# Air Pollution Technology, Inc., San Diego, Calif. **EFFECTS OF CONDITIONING AGENTS ON EMISSIONS FROM COAL-FIRED BOILERS: TEST REPORT NO. 1 Final Report, Jan. - Apr. 1978**

R. G. Patterson, P. Riersgard, R. Parker, and S. Calvert Apr. 1979 72 p refs 2 Vol.

(Contract EPA-68-02-2628; EPA Proj. EHE624A)

(PB-299191/7; EPA-600/7-79-104A)

Avail: NTIS

HC A04/MF A01 CSCL 13B

A field performance test of an electrostatic precipitator (ESP) which uses SO₃ as the conditioning agent was conducted. The ESP was at an electric utility power plant burning approximately 1% sulfur coal. The ESP performance was characterized in terms of particle collection efficiency and the chemical composition of particulate and gaseous emissions. Fly ash resistivity and dust opacity were also measured. Results show an average increase in overall efficiency from 80% to 95% with injection of the SO₃. This is accompanied by a decrease in fly ash resistivity, a decrease in opacity, and an increase in SO₃ concentration entering and leaving the ESP. Approximately 80% of the injected SO₃ escaped the ESP. GRA

N80-14591# Air Pollution Technology, Inc., San Diego, Calif. **EFFECTS OF CONDITIONING AGENTS ON EMISSIONS FROM COAL-FIRED BOILERS: TEST REPORT NO. 2 Final Report, Apr. - Jul. 1978**

R. G. Patterson, J. Long, R. Parker, and S. Calvert Apr. 1979 59 p 2 Vol.

(Contract EPA-68-02-2628; EPA Proj. EHE624A)

(PB-299192/5; EPA-600/7-79-104B)

Avail: NTIS

HC A04/MF A01 CSCL 13B

A field performance test of an electrostatic precipitator (ESP) which uses LPA 445 and LAC 51B flue gas conditioning agents was performed. The ESP is at an electric utility power plant burning approximately 1% to 2% sulfur coal. The ESP performance was characterized in terms of particle collection efficiency, chemical composition of particulate and gaseous emissions, fly ash resistivity, and dust opacity. Measurements show that there was no significant change in overall efficiency (99.6%) between the conditioned and unconditioned tests. There was some evidence that the conditioning agents reduced entrainment during electrode rapping and possibly improved the fractional efficiency slightly for particles smaller than about 5 micrometers in diameter. GRA

N80-14595# Battelle Columbus Labs., Ohio.

ENVIRONMENTAL ASSESSMENT OF THE FLUIDIZED-BED COMBUSTION OF COAL: METHODOLOGY AND INITIAL RESULTS

Keshava S. Murthy, Herman Nack, and D. Bruce Henschel (EPA) 1978 10 p refs Repr. from J. of Air Pollution Control Assoc., v. 28, no. 3, Mar. 1978 p 213-220 Presented at 70th Ann. APCA Meeting, Toronto, Jun. 1977 Revised Prepared in cooperation with Ind. Environ. Res. Lab.

(Contract EPA-68-02-2138)

(PB-298473/O; EPA-600/J-78-111; Paper-77-26.6-Rev) Avail: NTIS HC A02/MF A01 CSCL 13B

A program being conducted by the U.S. Environmental Protection Agency (EPA), aimed at complete environmental assessment (EA) of the fluidized-bed combustion (FBC) of coal is discussed. It reviews the EA methodology being developed by EPA: (1) identification of current technology and environmental background, including development of a list of the universe of potential pollutants; (2) development of environmental objectives via the Multimedia Environmental Goals chart; (3) comprehensive analysis of emissions from operating FBC systems; (4) assessment of existing control technology analysis of environmental control alternatives, using a Source Analysis Model approach; and (5) identification of further data and technology. GRA

N80-14617# Midwest Research Inst., Golden, Colo.

INSOLATION MODELS, DATA AND ALGORITHMS Annual Report, 1978

R. L. Hulstrom Dec. 1978 83 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-36-110) Avail: NTIS HC A05/MF A01

Operational computer models for thermal (broadband) and spectral insolation were developed along with a data base (SOLMET) for the U.S. geographical distribution of thermal insolation. Preliminary research measurements of the thermal insolation on tilted surfaces were performed and a complete design concept of advanced instrumentation to measure automatically the insolation on 37 tilted surfaces at various orientations was developed. DOE

N80-14655# Marlatt and Associates, Fort Collins, Colo.

ASSESSMENT OF THE APPLICABILITY OF THE NATIONAL FIRE WEATHER DATA LIBRARY TO WIND ENERGY ANALYSES Final Report

W. E. Marlatt, P. Tierney, P. Meilke, M. Baer, and J. Childs May 1979 115 p refs

(Contract EY-76-C-06-1830)

(PNL-2538) Avail: NTIS HC A06/MF A01

A program to review the fire weather library for stations with usable records, develop statistical summaries for selected individual stations and screen summaries for common windy areas,

develop statistical comparisons of fire weather stations with nonfire weather stations having multiple observations per day, develop frequency spectra of wind periods above threshold values, and estimate seasonal and geographic distributions of wind energy is described. The use of the data from the program for selection of sites with wind characteristics favorable for maximizing the wind energy potential is discussed. DOE

N80-14894# Department of Energy, Washington, D. C. Div. of Nuclear Power Development.

NUCLEAR POWER PROGRAM INFORMATION AND DATA: UPDATE, MARCH - APRIL 1979

1979 153 p refs

(DOE/TIC-10119) Avail: NTIS HC A08/MF A01

Information on nuclear power development, nuclear power plant construction, and nuclear power plant operation is presented. The economics of nuclear power and the fuel requirements and performance of nuclear generating units are discussed. The NRC review of the Three Mile Island accident is presented. A.W.H.

N80-14922* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

EFFECT OF VELOCITY OVERSHOOT ON THE PERFORMANCE OF MAGNETOHYDRODYNAMIC SUBSONIC DIFFUSERS

Mahesh S. Greywall (Wichita State Univ.) and J. Marlin Smith 1980 10 p refs Presented at Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; Sponsored by AIAA

(Contract EF-77-A-01-2674)

(NASA-TM-79305; DOE/NASA/2674-79/8; E-257) Avail: NTIS HC A02/MF A01 CSCL 201

The evolution of an overshoot velocity distribution was studied in a plane two dimensional diffuser as a function of diffuser divergence angle. The diffuser performance for velocity overshoot was compared to that for a fully developed inlet velocity profile. Results indicate that the ratio of peak-to-center line velocity increases along the diffuser for a diffuser half angle greater than some critical value. It was also found that irrespective of the accompanying inlet temperature distribution, the wall shear stress and the wall heat flux is substantially larger when the inlet velocity profile has an overshoot than that for a fully developed inlet velocity profile. R.C.T.

N80-14954# Argonne National Lab., Ill.

DISTRIBUTION AND CLASSIFICATION OF LOCAL SOCIO-ECONOMIC IMPACTS FROM ENERGY DEVELOPMENT

D. J. Santini and D. W. South 1979 20 p refs Presented at the 2nd Ann. Conf. on the Small City and Regional Community, Stevens Point, Wis., 15 Apr. 1979

(Contract W-31-109-eng-38)

(CONF-790481-1) Avail: NTIS HC A02/MF A01

Present and proposed energy facility siting patterns are examined and their socio-economic impact is assessed. Results show that: (1) new electric capacity will shift from oil and gas to coal and nuclear fuels; (2) coal and nuclear plants require more labor per megawatt than oil and gas plants; (3) coal and nuclear plants are larger than gas or oil plants; (4) new coal and nuclear plants will be larger than such existing plants; (5) among regions, greater shares of energy production will occur in those regions less able to assimilate employment growth; and (6) within regions, greater shares of energy production will occur in counties less able to assimilate employment growth. These results clearly demonstrate that socio-economic impact from energy development will be greater in the future than in the past. DOE

N80-14962# Arizona Univ., Tucson. Office of Arid Lands Studies.

WEST COAST FORUM ON APPROPRIATE TECHNOLOGY Final Report

Kenneth E. Foster, Roger L. Caldwell, Terry Triffet, and Lina K. Robinson Feb. 1979 56 p Forum held at Tucson, Ariz., 21 Sep. 1978

(Contract NSF CISP-78-22989)

(PB-298986/1; NSF/RA-790003) - Avail: NTIS HC A04/MF A01 CSCL 05A

Scientific research support to promote successful performance of appropriate technology (AT) projects is considered including the provision of a scientific educational base as well as an understanding of the societal and economic impacts related to the adoption of AT. Some of the predominant topic areas identified for research include alternative energy sources, small-scale urban organic agriculture technology, alternative waste disposal systems, and water conservation technology. GRA

N80-14972# Department of Energy, Washington, D. C. **COMMERCIALIZATION STRATEGY REPORT FOR ELECTRIC AND HYBRID VEHICLES**

P. Brown, P. Davis, G. Hagey, and M. Katz [1979] 91 p (TID-28858-Draft) Avail: NTIS HC A05/MF A01

Barriers to the commercialization of electric powered vehicle technology are identified, along with possible actions to remove specific barriers. Technical, economic, environmental, and institutional readiness are assessed. Recommended commercialization strategies and goals are presented. K.L.

N80-14973# California Univ., Livermore. Lawrence Livermore Lab.

ASSESSMENT OF THE APPLICABILITY OF MECHANICAL ENERGY STORAGE DEVICES TO ELECTRIC AND HYBRID VEHICLES. VOLUME 1: EXECUTIVE SUMMARY M.S. Thesis

M. W. Schwartz 1 May 1979 17 p refs

(Contract W-7405-eng-48)

(UCRL-52773-Vol-1) Avail: NTIS HC A02/MF A01

The power and energy required in a storage device to realize specific improvements upon current and near-term electric vehicle performance specifications are calculated. A review of candidate mechanical energy storage devices concludes that only flywheels and, for some applications, hydraulic accumulators are practical in this context. With respect to each performance specification, data is presented on the vehicle-mass fraction of the mechanical energy storage system as a function of its specific energy and the overall vehicle mass. Mechanical energy storage devices may or may not improve range, depending on the particular configuration of the vehicle and the driving cycle. DOE

N80-14976# Department of Energy, Bartlesville, Okla. Bartlesville Energy Research Center.

AMBIENT TEMPERATURE, FUEL ECONOMY, EMISSIONS, AND TRIP LENGTH Final Report, Feb. - Sep. 1977

B. H. Eccleston Aug. 1979 123 p

(Contract DOT-TSC-RA-76-48)

(PB-298847/5; DOT-TSC-NHTSA-79-43; DOT-HS-803-668) Avail: NTIS HC A06/MF A01 CSCL 13F

The relationship among automotive fuel economy, ambient temperature, cold start trip length, and drive-train component temperatures of four 1977 vehicles is examined. Fuel economy, exhaust emission, and drive-train temperatures were measured at temperatures of 20 F, 45 F, 70 F, and 100 F using the 1975 Federal Test Procedure and EPA highway fuel economy test. GRA

N80-15133* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

IMPACT OF NEW INSTRUMENTATION ON ADVANCED TURBINE RESEARCH

Robert W. Graham Mar. 1980 25 p refs Proposed for presentation at the 1980 Spring Ann. Meeting, New Orleans, 5-13 Mar. 1980; sponsored by ASME

(NASA-TM-79301; E-251) Avail: NTIS HC A02/MF A01 CSCL 21E

A description is presented of an orderly test program that progresses from the simplest stationary geometry to the more complex, three dimensional, rotating turbine stage. The instrumentation requirements for this evolution of testing are described.

The heat transfer instrumentation is emphasized. Recent progress made in devising new measurement techniques has greatly improved the development and confirmation of more accurate analytical methods for the prediction of turbine performance and heat transfer. However, there remain challenging requirements for novel measurement techniques that could advance the future research to be done in rotating blade rows of turbomachines. M.M.M.

N80-15195* Boeing Aerospace Co., Seattle, Wash.

SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY

Nov. 1979 39 p. Prepared in cooperation with General Elec. Co., Fairfield, Conn.; Grumman Aerospace Corp., N. Y.; Little (Arthur D.), Inc., Cambridge, Mass.; TRW, Inc., Cleveland, Ohio; Brown and Root, Inc., Houston, Tex.

(Contract NAS9-15636)
(NASA-CR-160442; D180-25461-1) Avail: NTIS
HC A03/MF A01 CSCL 11B

Configuration concepts, option sizes, and systems definitions study design evolutions are reviewed. The main features of the present reference design silicon solar cell solar power satellite are described, as well as the provisions for space construction and support systems. The principal study accomplishments and conclusions are summarized according to the following tasks: (1) baseline critique; (2) construction and maintenance; (3) industrial complex needs, cost estimates, and production capacity; (4) launch complex requirements at KSC or at an offshore facility; (5) integration of the SPS/ground power network; (6) technology advancement and development; (7) costs and schedules; and (8) exploratory technology: laser annealing of solar cells degraded by proton irradiation, and a fiber-optic phase distribution link at 980 MHz. A.R.H.

N80-15204* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF GaAs AND Si SOLAR CELL ARRAYS FOR EARTH ORBITAL AND ORBIT TRANSFER MISSIONS

Kent D. Jeffries 1980 9 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE

(NASA-TM-81383; E-291) Avail: NTIS HC A02/MF A01 CSCL 21C

Silicon and gallium arsenide arrays were studied and compared for low earth orbit (LE), geosynchronous orbit (GEO), and LEO to GEO electric propulsion orbit transfer missions. The sensitivities of total cost to parameters such as mission duration, array cost, cover glass thickness, and concentration ratio were determined along with cost tradeoffs between silicon and gallium arsenide arrays for selected mission classes. Results indicate that development of the technology for low cost, light weight concentrators should be increased and that cost reduction efforts for gallium arsenide cells be pursued. R.C.T.

N80-15220# Department of Energy, Washington, D. C.

ANALYSIS OF HYDROGEN IN SOLIDS

R. L. Schowebel, ed. and J. L. Warren, ed. Apr. 1979 181 p refs Presented at the Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979

(Contract DE-AC04-76DP-00789)
(DOE/ER-0026; CONF-790127) Avail: NTIS
HC A09/MF A01

The ways to determine the state and dynamics of hydrogen in solids are presented and requirements are formulated for techniques in this capacity. Topics include: the properties of hydrogen in insulating materials; ion channeling studies of hydrogen lattice location; hydrogen depth profiling using elastic recoil detection; and neutron scattering as a technique for the study of hydrogen in metals. A.W.H.

N80-15227# Brookhaven National Lab., Upton, N. Y.

HIGH TEMPERATURE ELECTROLYSIS

J. R. Powell 1978 6 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979

(Contract EY-76-C-02-0016)

(BNL-26331; CONF-791103-16)
HC A02/MF A01

Avail: NTIS

An idealized flowsheet for a high temperature electrolysis fusion synthetic fuel plant is given. Two blanket module types are indicated; the first type heats steam or CO₂ to high temperatures for the HTE cells ($T > \text{or} = 1000^\circ\text{C}$) while the second heats a working fluid for an electrical power cycle and breeds tritium. DOE

N80-15259# Argonne National Lab., Ill.

LONG-TERM EROSION MONITORING OF METALLIC CONDUITS BY ULTRASONIC PULSE-ECHO TECHNIQUES

C. A. Youngsdaahl and W. A. Ellingson 1979 11 p refs Presented at 12th Symp. on Nondestructive Evaluation, San Antonio, Tex., 24 Apr. 1979

(Contract W-31-109-eng-38)
(CONF-790480-1) Avail: NTIS HC A02/MF A01

Monitoring metallic transfer lines and fittings in pressurized equipment used to process particulate matter, such as pulverized coal or ash, can prevent unexpected component failures and contribute to improved equipment designs. Nondestructive, ultrasonic pulse-echo techniques to detect erosion were developed for high-temperature (approximately 650 C) on-line measurements and applied to various stainless steel and carbon steel components of coal-gasification and liquefaction pilot plants. The techniques are described, together with successful methods of accounting for varying specimen temperatures, long monitoring times (months to years), and exposure of transducers and couplant to weather. Measurement characteristics peculiar to erosion monitoring are discussed. DOE

N80-15263* General Electric Co., Philadelphia, Pa. Space Sciences Lab.

SINTERED SILICON NITRIDE RECUPERATOR FABRICATION Final Report

A. Gatti, W. S. Chiu, and L. R. McCreight Jan. 1980 40 p refs

(Contract DEN3-54)
(NASA-CR-159706; DOE/NASA/0054-79/1) Avail: NTIS
HC A03/MF A01 CSCL 11B

The preliminary design and a demonstration of the feasibility of fabricating submodules of an automotive Stirling engine recuperator for waste heat recovery at 370 C are described. Sinterable silicon nitride (Sialon) tubing and plates were fabricated by extrusion and hydrostatic pressing, respectively, suitable for demonstrating a potential method of constructing ceramic recuperator-type heat exchangers. These components were fired in nitrogen atmosphere to 1800 C without significant scale formation so that they can be used in the as-fired condition. A refractory glass composition ($\text{Al}_2\text{O}_3 \times 4.5 \text{ CaO} \cdot \text{MgO} \times 11 \text{ SiO}_2$) was used to join and seal component parts by a brazing technique which formed strong recuperator submodules capable of withstanding repeated thermal cycling to 1370 C. The corrosion resistance of these materials to $\text{Na}_2\text{SO}_4 + \text{NaCl}$ carbon mixtures was also assessed in atmospheres of air, hydrogen and CO₂-N₂-H₂O mixtures at both 870 C and 1370 C for times to 1000 hours. No significant reaction was observed under any of these test conditions. M.M.M.

N80-15275# National Bureau of Standards, Washington, D.C.
MEASUREMENTS AND STANDARDS FOR RECYCLED OIL - 2

Donald A. Becker, ed. and Helen Anne Hurd Sep. 1979 218 p refs Presented at NBS Conf., Gaithersburg, Md., 29-30 Nov. 1977

(PB-299951/4; NBS-SP-556; LC-79-600126) Avail: NTIS
HC A10/MF A01 CSCL 11H

Progress in the development of measurement methods and test procedures, as well as standards, for recycled oil is reported. Areas of legislation which affect the recycled oil program are discussed along with environmental issues. Other topics covered include oil recycled as engine oils, nonlubricating end uses, and additional recycled oil activities. GRA

N80-15276# SRI International Corp., Menlo Park, Calif.
MISSION ANALYSIS FOR THE FEDERAL FUELS FROM BIOMASS PROGRAM. VOLUME 3: FEEDSTOCK AVAILABILITY Final Report

R. K. Ernest, R. H. Hamilton, N. S. Borgeson, F. A. Schooley, and R. L. Dickenson Jan. 1979 79 p refs
 (Contract EY-76-C-03-0115)
 (SAN-0115-T1) Avail: NTIS HC A05/MF A01

The biomass supply in the United States is estimated through the year 2020. The biomass supply represents the combined tonnages of agricultural, logging, and mill residues, other forest residues, and energy crop output. Two scenarios were used for the projections: a base case and an optimistic case reflecting increases in land and water availability for production of energy crops resulting from an array of government incentives. An appendix tabulates the feedstock availability by region, type, price, year, and scenario. DOE

N80-15277# Puerto Rico Scientific Research Lab., Inc., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1978 - 1979

A. G. Alexander, M. Garcia, C. Gonzalez-Molina, and J. Ortez-Velez 1979 62 p refs
 (Contract ET-78-S-05-5912)
 (DOE/CS/5912-T1; QR-2) Avail: NTIS HC A04/MF A01

Candidate grasses were identified for short-rotation crops having potentially greater versatility than Sordan 70A. Field-plot studies were performed on the optimization of N-fertilization and seeding rates for Sordan 70A. Field-plot data were recorded on sugarcane and napier grass responses to harvest frequency and row spacing. These results underscore a superiority of first-ratoon yields over plant-crop yields, of napier grass over sugarcane (up to 4 months), and delayed harvests over frequent harvests. Breeding tests were successful in producing F1 seedlings from crosses between an unknown and early-tasseling wild S. Spontaneum hybrid and late-tasseling commercial sugarcane hybrids. DOE

N80-15278# Institute of Gas Technology, Chicago, Ill.
LNG INDUSTRY: AN OVERVIEW OF PROJECTS AND COSTS

J. Glenn Seay, Philip J. Anderson, and Edward J. Daniels 1978 29 p Presented at ASME Energy Tech. Conf., Houston, Tex., 5 Nov. 1978
 (Contract EE-76-C-02-4234)
 (CONF-781112-2) Avail: NTIS HC A03/MF A01

A summary of the LNG projects that are currently in various stages of development is presented. These projects account for a potential international LNG trade of about 765 million cu m (27 billion CF) per day. The operating experiences of some of the currently operational projects are reviewed with an emphasis on the natural gas liquefaction facilities. DOE

N80-15279# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.

PROJECT PLANNING DOCUMENT: HIGHWAY VEHICLE ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP)

Jul. 1979 66 p
 (DOE/CS-0093) Avail: NTIS HC A04/MF A01

Criteria and guidelines for the evaluation and development of nonpetroleum based highway vehicle fuels derived from domestic resources are developed. Five basic classes of alternative fuels are presented. Within each class, general areas of R & D that were addressed are illustrated in terms of a matrix format, while specific project relationships are identified by a corresponding flow chart. An overview of the evaluation of and relationships between these several alternative fuels classes intended to progress toward a uniform and independent domestic highway transportation system is presented. The mechanism for implementation is outlined. DOE

N80-15280# Department of Energy, Washington, D. C.
ETHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUELS

J. R. Allsup and D. B. Eccleston 1979 13 p refs Presented

at the 3rd Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979

(CONF-790520-5) Avail: NTIS HC A02/MF A01

An experimental study of gasoline and 10% ethanol/90% gasoline blends was made using five late-model vehicles operated on a climate controlled chassis dynamometer. Data were obtained to permit comparisons of fuel economy, emissions, and other significant operational characteristics observed in tests with the two fuels. Volumetric fuel economy was shown to be slightly decreased, while energy economy was slightly increased using the ethanol/gasoline blend. Compared with the results using base gasoline, the use of the ethanol/gasoline blend had no adverse effect upon regulated emissions at test temperatures within the range 20 to 75 F; at 100 F there were mirror increases in emissions using the ethanol/gasoline blends. DOE

N80-15281# Argonne National Lab., Ill.
ENVIRONMENTAL PLANNING AND ASSESSMENT FOR HIGHWAY VEHICLE USE TO ALCOHOL FUELS

M. J. Bernard, III and O. M. Bevilacqua 1979 12 p refs
 Presented at 3d Intern. Alcohol Fuels Technol., Asilomar, Calif., 28 May 1979

(Contract W-31-109-eng-38)

(CONF-790520-2) Avail: NTIS HC A02/MF A01

The DOE environmental evaluation process designed to implement the National Environmental Policy Act policies and guidance is presented. In particular, it focused on that process as it is being used for DOE's alcohol fuels project within the Office. DOE

N80-15282# California Univ., Livermore. Lawrence Livermore Lab.

SIMULATION OF LNG VAPOR SPREAD AND DISPERSION BY FINITE ELEMENT METHODS

S. T. Chan, P. M. Gresho, and R. L. Lee Jul. 1979 36 p refs
 Presented at Natl. Conf. on Numerical Methods in Heat Transfer, College Park, Md., 24 Sep. 1979
 (Contract W-7405-eng-48)

(UCRL-82441; CONF-790915-1)

Avail: NTIS

HC A03/MF A01

Two finite element models (one based on solving the time dependent, two dimensional conservation equations of mass, momentum, and energy, with buoyancy effects included via the Boussinesq approximation; the other based on solving the otherwise identical set of equations except using the hydrostatic assumption) are described and applied to predict some aspects of the vapor dispersion phenomena associated with liquefied natural gas (LNG) spills. A number of controlled numerical experiments, representing a reasonable expected range of LNG spill scenarios and atmospheric conditions, were carried out. Data regarding the applicability and limitations of the hydrostatic assumption for predicting LNG vapor spread and dispersion are established on comparing the results obtained with these finite element models. DOE

N80-15287# Department of Energy, Washington, D. C.
COMMERCIALIZATION STRATEGY REPORT FOR RECOVERY OF NATURAL GAS FROM UNCONVENTIONAL SOURCES

J. Ham, S. E. Atkinson, and L. Dewey 1978 90 p refs
 (TID-28848-Draft) Avail: NTIS HC A05/MF A01

Tight gas sands and Devonian shale are ready for commercialization, although higher than historical gas prices, improved recovery technology, and an aggressive commercialization program are required to fully develop these resources. Coalbed methane for local (non-pipeline) markets appears ready for commercialization for the local (self-help) industrial or municipal market. Coalbed methane for pipeline markets does not appear ready for commercialization in the near term due to highly uncertain geologic properties, economic uncertainties, perceived safety hazards, and limited interest by mine operators. Geopressed aquifers do not appear ready for commercialization in the near term because of vast geologic, technical, and environmental uncertainties and high production costs. Given a gap in domestic supplies to 6 to 8 Tcf in 1990, gas from the unconventional, domestic sources could fill 3 to 6 Tcf of this gap. DOE

N80-15288# Sandia Labs., Albuquerque, N. Mex.
LOW TEMPERATURE REACTION PATH FOR COAL LIQUEFACTION

M. G. Thomas and R. K. Traeger 1979 14 p refs Presented at the Am. Chem. Soc. Natl. Meeting, Washington, D.C., 10 Sep. 1979

(Contract EY-76-C-04-0789)

(SAND-79-0738C: CONF-790917-7) Avail: NTIS HC A02/MF A01

The applicability of advanced, two-stage liquefaction processes which could lead to the development of new, low temperature and pressure liquefaction schemes is evaluated. DOE

N80-15289# Los Alamos Scientific Lab., N. Mex.
NEW HEAT TRANSFER GEOMETRY FOR HYDRIDE HEAT ENGINES AND HEAT PUMPS

W. A. Steyert Jul. 1979 7 p refs

(Contract W-7405-eng-36)

(LA-7822) Avail: NTIS HC A02/MF A01

A porous metal hydride (LiNi₅H₆) composite is presented that provides both mechanical stability to hydride beds and excellent heat transfer to the hydride when used in the appropriate configuration. DOE

N80-15290# Department of Energy, Washington, D. C.
REPORT OF THE ALCOHOL FUEL POLICY REVIEW

Jun. 1979 117 p

(DOE/PE-0012) Avail: NTIS HC A06/MF A01

Policy studies were conducted to assess the potential of alcohol fuels as an alternative source of energy. The conclusions of the analysis are summarized and recommendations to stimulate the use of alcohol fuels from renewable resources are presented, including major policies that the President has endorsed. R.E.S.

N80-15291# Arizona State Univ., Tempe. College of Engineering and Applied Sciences.

CONVERSION OF CELLULOSIC AND WASTE POLYMER MATERIAL TO GASOLINE

J. L. Kuester 28 Mar. 1979 52 p refs

(COO-2982-38) Avail: NTIS HC A04/MF A01

The present status and future plans for a project to convert cellulosic (biomass) and waste synthetic polymer materials to quality liquid fuels is presented. A thermal gasification approach was utilized followed by catalytic liquid fuels synthesis steps. Potential products include a medium quality substitute for natural gas or liquid fuel equivalents of diesel fuel, kerosene or high octane gasoline. The process appears very flexible with regard to ability to handle different sources of feedstock. Results to date indicate quality products can be produced. Product yields need to be improved with the main thrust centered on improvement of pyrolysis gas composition. Other items to be addressed are study of alternate economic feedstocks, waste stream characterization, and liquid fuels synthesis and tailoring with particular attention on the effects of alternate feedstocks. A description of a proposed 10 ton/day pilot plant is presented with flow sheet, material balance and cost estimates. DOE

N80-15293# Oregon State Univ., Corvallis.
INVESTIGATION OF THE VIABILITY AND COST EFFECTIVENESS OF SOLID FUEL GASIFIERS CLOSE COUPLED TO INTERNAL COMBUSTION ENGINES FOR 200 kW_e POWER GENERATION Progress Report

J. G. Mingle and D. C. Junge Jan. 1979 52 p refs

(Contract EY-76-S-06-2227)

(DOE/RL-90476-13; PR-9; RLO-2227-T22-13) Avail: NTIS HC A04/MF A01

The viability and cost effectiveness of a 200 kW_e engine generator unit fueled by a direct coupled, solid fuel gasifier were studied. Fuel and gasifier technology, gas treatment (clean up) for engine use, engine use technology, other uses for gasifiers, the viability of close coupled units, and an estimate of cost effectiveness are discussed. Present small experimental gasifier systems were found to perform as expected and have served to demonstrate the technology. Certain needed development efforts are discussed. DOE

N80-15294# TRW Defense and Space Systems Group, Redondo Beach, Calif.

COAL SULFUR MEASUREMENTS Final Report, Jan. 1976 - Dec. 1978

J. W. Hamersma and M. L. Kraft Jul. 1979 76 p refs

(Contract EPA-68-02-2165)

(PB-299575/1; EPA-600/7-79-150)

Avail: NTIS

HC A05/MF A01 CSCL 081

A technique for sulfur forms analysis based on low temperature oxygen plasma ashing is presented. It involves analyzing the low-temperature plasma ash by modified ASTM techniques after selectively removing the organic material. The procedure was tested on 25 coals and compared with ASTM analyses with excellent results. A separate set of experiments showed that it is also feasible to determine organic sulfur directly by trapping SO_x in the plasma ash effluent. GRA

N80-15296# Purdue Univ., Lafayette, Ind. School of Materials Engineering.

SULFUR FIXATION DURING COAL GASIFICATION Final Report, 1 Mar. 1975 - 28 Feb. 1978

R. Schuhmann, Jr., R. H. Spitzer, and A. J. Mehta 15 Dec. 1978 107 p refs

(Grant NSF AER-75-02665)

(PB-301104/6; PRF-8601) Avail: NTIS HC A06/MF A01 CSCL 07A

The development of basic engineering data for design of a coal gasification process in which the sulfur is fixed and separated in chemical combination with iron is reported. Results of thermodynamic calculations and phase equilibrium studies conducted for the ternary condensed systems Fe-O-S and Fe-C-S, and for equilibria of condensed phases in these systems with gases containing various combinations of C, O, H, and S are given. It is shown that iron oxides, metallic iron, and iron silicates should be effective sulfur fixation agents over wide ranges of gas compositions and gasification temperature, both below and above the melting point of iron sulfide. GRA

N80-15297# Texas A&M Research Foundation, College Station. Dept. of Chemical Engineering.

CONVERSION OF COAL-BASED METHANOL TO ETHYLENE AND A GASEOUS FUEL Final Report, 1 Oct. 1975 - 30 Sep. 1978

Rayford G. Anthony 1 Dec. 1978 47 p ref

(Grant NSF AER-74-20135)

(PB-301256/4; NSF/RA-780616)

Avail: NTIS

HC A03/MF A01 CSCL 07A

Development of a catalytic process which converts methanol into ethylene and a gaseous fuel similar to natural gas is reported. An AW500 type catalyst proved to be the best catalyst for converting methanol into ethylene. 80 to 98 percent of the alcohol being converted into 16 to 60 percent yields of ethylene. Coal-based methanol was converted into a gaseous mixture composed of 50 percent dimethyl ether, 33.3 percent hydrogen and 16.7 percent carbon monoxide by passing the alcohol over alumina and zinc chromite catalysts at 300-500 C. The major cost of producing ethylene or gaseous fuel is the initial cost of synthesis gas produced from coal that is subsequently used to produce methanol. GRA

N80-15298# New Mexico Energy Inst., Las Cruces.

ECONOMIC ANALYSIS OF SMALL SCALE BIOCONVERSION UNITS IN NEW MEXICO Final Report, 1 Sep. 1977 - 31 May 1979

Wendell Hull and Eugene E. Staffeldt Jun. 1979 156 p refs

(Contract EMD-77-2202)

(PB-301390/1; NMEI-37) Avail: NTIS HC A08/MF A01 CSCL 21D

Three New Mexico agribusinesses were analyzed to find an economic method for converting biomass from agricultural sources to methane. Primary design goals were simplicity, least-cost

construction, and safe operation. Two basic digestion systems were designed. They vary only in digester vessel and related component size, not in operation. Each system was evaluated with respect to cost and operational characteristics. Recommendations are given for each business studied. GRA

N80-15304# New Brunswick Electric Power Commission, Fredericton, Commercial Div.

MEASUREMENT OF ENERGY TO HEAT HOUSES: INITIAL STUDY

Verne Ireton 6 Jun. 1979 35 p refs
(PB-299448/2) Avail: NTIS HC A03/MF A01 CSCL 13A

A program of measurement of the energy consumed for residential space heating was instituted during the summer of 1978. It was felt that heat loss calculations are very conservative and that there is a much larger difference between the energy consumed by a combustion system and an electrical system than that calculated by assuming a furnace efficiency or a 'seasonal performance factor'. The results obtained during the 1978/79 heating season are presented. GRA

N80-15346# Brookhaven National Lab., Upton, N. Y.
PARTIAL DISCHARGE PERFORMANCE OF LAPPED PLASTIC INSULATION FOR SUPERCONDUCTING POWER TRANSMISSION CABLES AND THE DIELECTRIC STRENGTH OF SUPERCRITICAL HELIUM GAS

A. J. Pearmain (University College, Dublin, Ireland), M. Kosaki (Nagoya Univ., Japan), and R. A. Thomas 1978 11 p refs
Presented at Conf. on Elec. Insulation and Dielectric Phenomena, Pocono Manor, Pa., 29 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-24779; CONF-781027-2) Avail: NTIS
HC A02/MF A01

A superconducting power transmission cable was designed using a flexible ac cable with Nb3Sn superconductor force cooled by supercritical helium. A lapped, multilayer plastic tape construction was selected for the electrical insulation with supercritical helium gas filling the butt spaces between tapes. Evaluation of many different tapes showed biaxially oriented laminated polypropylene tape to be a promising dielectric. A series of tests on short samples of insulation wound in a cable-type configuration enabled improvements to be made in screen design and winding techniques. Some partial discharge results from short sample tests are described, and an apparatus with variable electrode spacing developed for studying the effect of electrode material, spacing and area on the breakdown strength of supercritical helium is discussed. DOE

N80-15420# Environmental Protection Agency, Ann Arbor, Mich. Inspection and Maintenance Staff.

EFFECTS OF INSPECTION AND MAINTENANCE PROGRAMS ON FUEL ECONOMY

Mar. 1979 15 p refs
(PB-297583/7; IMS-001/FE/1) Avail: NTIS
HC A02/MF A01 CSCL 13B

The primary goal of inspection and maintenance (I/M) programs is to improve air quality by reducing emissions from motor vehicles. Many studies indicate that I/M programs will achieve this goal. In addition several studies indicate that fuel economy improvement can be expected to occur as a result of maintenance performed on vehicles failing an I/M test. Most studies looked at pre-1975 model year vehicles and had expert mechanics performing the maintenance work. Both the results from past studies and the results from more recent studies are considered to provide EPA's best estimates of fuel economy benefit which can be attributed to I/M maintenance. GRA

N80-15422# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

PHOTOVOLTAIC POWER SYSTEM RELIABILITY CONSIDERATIONS

Vincent R. Lalli 1980 9 p refs Presented at the Ann. Reliability and Maintainability Symp., San Francisco, 22-24 Jan. 1980
(Contract DE-AB29-76EI-20370)

(NASA-TM-79291; DOE/NASA/20370-79/19; E-235) Avail: NTIS HC A02/MF A01 CSCL 14D

An example of how modern engineering and safety techniques can be used to assure the reliable and safe operation of photovoltaic power systems is presented. This particular application is for a solar cell power system demonstration project designed to provide electric power requirements for remote villages. The techniques utilized involve a definition of the power system natural and operating environment, use of design criteria and analysis techniques, an awareness of potential problems via the inherent reliability and FMEA methods, and use of fail-safe and planned spare parts engineering philosophy. J.M.S.

N80-15428# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

A RELATION BETWEEN SEMIEMPIRICAL FRACTURE ANALYSES AND R-CURVES

Thomas W. Orange Jan. 1980 45 p refs
(NASA-TP-1600; E-9963) Avail: NTIS HC A03/MF A01 CSCL 20K

The relations between several semiempirical fracture analyses (SEFA) and the R-curve concept of fracture mechanics are examined and the conditions for equivalence between a SEFA and an R-curve are derived. A hypothetical material is employed to study the relation analytically. Equivalent R-curves are developed for several real materials using data from the literature. For each SEFA there is an equivalent R-curve whose magnitude and shape are determined by the SEFA formulation and its empirical parameters. If the R-curve is indeed unique, then the various empirical parameters cannot be constant, and vice versa. However, for one SEFA the differences are small enough that they may be within the range of normal data scatter for real materials. Author

N80-15544# Bureau of Mines, Denver, Colo. Mining Research Center.

THREE POTENTIAL LONGWALL MINING METHODS FOR THICK COAL SEAMS IN THE WESTERN UNITED STATES

Richard H. Otto 1979 41 p refs
(PB-299568/6; BM-IC-8792) Avail: NTIS HC A03/MF A01 CSCL 08I

Three longwall mining methods practiced in foreign countries are described. Potential for increasing underground recovery and productivity in thick coalbeds of the western United States is emphasized. The methods are multislice longwalling, longwall caving, and high-face longwalling. Foreign practices and possible application in the United States are discussed. GRA

N80-15553# Technical Report Services, Rocky River, Ohio.
EVALUATION OF FEASIBILITY OF PRESTRESSED CONCRETE FOR USE IN WIND TURBINE BLADES

Seymour Leiblein, D. S. Londahl, Donn B. Furlong, and Mark E. Dreier Sep. 1979 119 p refs Prepared in cooperation with Tuthill Pump Co., San Rafael, Calif. and Paragon Pacific, Inc., El Segundo, Calif.
(Contracts NAS3-20596; NAS3-30813; EX-76-I-01-1028; NASA Order C-25906)
(NASA-CR-159725; DOE/NASA/5906-79/1) Avail: NTIS
HC A06/MF A01 CSCL 10B

A preliminary evaluation of the feasibility of the use of prestressed concrete as a material for low cost blades for wind turbines was conducted. A baseline blade design was achieved for an experimental wind turbine that met aerodynamic and structural requirements. Significant cost reductions were indicated for volume production. Casting of a model blade section showed no fabrication problems. Coupled dynamic analysis revealed that adverse rotor tower interactions can be significant with heavy rotor blades. R.C.T.

N80-15554# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

SPACE SOLAR CELLS: HIGH EFFICIENCY AND RADIATION DAMAGE

Henry W. Brandhorst, Jr. and Daniel T. Bernatowicz 1980 12 p refs Presented at 14th Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980; sponsored by IEEE (NASA-TM-81387; E-297) Avail: NTIS HC A02/MF A01 CSCL 10A

The progress and status of efforts to increase the end-of-life efficiency of solar cells for space use is assessed. High efficiency silicon solar cells, silicon solar cell radiation damage, GaAs solar cell performance and radiation damage and 30 percent devices are discussed. R.E.S.

N80-15560* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CANDIDATE THERMAL ENERGY STORAGE TECHNOLOGIES FOR SOLAR INDUSTRIAL PROCESS HEAT APPLICATIONS

Edward R. Furman 1979 12 p refs Presented at Solar Industrial Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979; sponsored by Solar Energy Res. Inst. (Contract EC-77-A-31-1034)

(NASA-TM-81380; DOE/NASA/1034-79/6; E-285) Avail: NTIS HC A02/MF A01 CSCL 10A

A number of candidate thermal energy storage system elements were identified as having the potential for the successful application of solar industrial process heat. These elements which include storage media, containment and heat exchange are shown. R.C.T.

N80-15562* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Materials and Processes Lab.

CHARACTERIZATION OF THREE TYPES OF SILICON SOLAR CELLS FOR SEPS DEEP SPACE MISSIONS. VOLUME 1: CURRENT-VOLTAGE CHARACTERISTICS OF OCCL BSF/BSR 10 ohm-cm, AND BSR 2 ohm-cm CELLS AS A FUNCTION OF TEMPERATURE AND INTENSITY

A. F. Whitaker, S. A. Little, C. F. Smith, Jr., and V. A. Wooden Nov. 1979 93 p refs (NASA-TM-78253) Avail: NTIS HC A05/MF A01 CSCL 10A

Three types of high performance silicon solar cells, BSF/BSR 10 ohm-cm, BSR 10 ohm-cm, and BSR 2 ohm-cm, were evaluated for their low temperature and low intensity performance. Sixteen cells of each type were subjected to ten temperatures and nine intensities. The BSF/BSR 10 ohm-cm cells provided the best performance at 1 solar constant and ± 25 C with an efficiency of 14.1% while the BSR 2 ohm-cm cells had the highest low temperature and low intensity performance with an efficiency of 22.2% at 0.04 solar constant and -170 C and the most consistent cell-to-cell characteristics. R.E.S.

N80-15563* Alabama Univ., Huntsville.

A SURVEY OF PHOTOVOLTAIC SYSTEMS

Aug. 1979 213 p Sponsored in part by DOE (Contract NAS8-31293)

(NASA-CR-150696) Avail: NTIS HC A10/MF A01 CSCL 10A

Solar photovoltaic manufacturers and suppliers are listed. Data sheets on specific products and typical operating, installation, or maintenance instructions and procedures are appended. R.E.S.

N80-15564* California Univ., Livermore. Lawrence Livermore Lab.

NOVEL SCHEME FOR MAKING CHEAP ELECTRICITY WITH NUCLEAR ENERGY

J. A. Pettibone 24 Aug. 1979 23 p refs

(Contract W-7405-eng-48)

(UCID-18153-Rev-1) Avail: NTIS HC A02/MF A01

Nuclear fuels should produce cheaper electricity than coal, considering their high specific energy and low cost. To exploit these properties, the scheme proposed here replaces the expensive reactor/steam-turbine system with an engine in which the expansion of a gas heated by a nuclear explosion raises a mass of liquid, thereby producing stored hydraulic energy. This energy could be converted to electricity by hydroelectric generation with

water as the working fluid or by magnetohydrodynamic (MHD) generation with molten metal. A rough cost analysis suggests the hydroelectric system could reduce the present cost of electricity by two-thirds, and the MHD system by even more. Such cheap power would make feasible large-scale electrolysis to produce hydrogen and other fuels and chemical raw materials. DOE

N80-15565# Los Alamos Scientific Lab., N. Mex.

DECENTRALIZED SOLAR PHOTOVOLTAIC ENERGY SYSTEMS

M. C. Krupta Jun. 1979 110 p refs

(Contract W-7405-eng-36)

(LA-7866-TASE) Avail: NTIS HC A06/MF A01

A model residential photovoltaic system which utilizes a solar cell array roof shingle combination is discussed in relation to developing and generating the environmental data for decentralized solar photovoltaic systems. Material requirements, operating residuals, land requirements, water requirements, production processes, and production residuals for the systems operation are examined. Environmental, health, safety, and resource availability impacts are reported. A.W.H.

N80-15566# Sandia Labs., Albuquerque, N. Mex.

DESIGN OF PHOTOVOLTAIC SYSTEMS FOR RESIDENTIAL APPLICATIONS IN THE UNITED STATES

G. J. Jones 1979 7 p refs Presented at the Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979

(Contract DE-AC04-76DP-00789)

(SAND-78-2186C; CONF-790457-3)

Avail: NTIS HC A02/MF A01

Photovoltaic system configurations for single family residences were analyzed to determine the optimum design. Cost effectiveness and the effect of climate on the 15 regions studied were determined as factors in the analysis. The interaction of the residential photovoltaic system with the local utility is discussed and the economic viability of onsite energy storage is examined. A.W.H.

N80-15568# California Univ., Berkeley. Lawrence Berkeley Lab.

GEOHERMAL ENERGY DEVELOPMENT FROM THE SALTON TROUGH TO THE HIGH CASCADES

N. E. Goldstein Jan. 1979 15 p refs Presented at the 3rd Natl. Conf. and Exhibition on Technol. for Energy Conserv., Tucson, Ariz. 23-25 Jan. 1979

(Contract W-7405-eng-48)

(LBL-8703; CONF-790107-10)

Avail: NTIS HC A02/MF A01

Operations at Cerro Preto, the only water-dominated geothermal field currently generating electric power in North America, were assessed to identify potential problems which might face U.S. producers in the Imperial Valley. Geological hydrogeological, geochemical, and geophysical characteristics of the Salton Trough were investigated, as well as those of Mt. Hood, Oregon, where drilling was conducted, as a preliminary to determining the geothermal potential of the entire Cascade Range. A.R.H.

N80-15569# EIC, Inc., Newton, Mass.

CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED FILMS Semiannual Report, 15 May - 30 Nov. 1978

S. B. Brummer, V. R. Koch, and G. H. Schnaper Jan. 1979 44 p refs

(Contract EM-78-C-04-4297)

(COO-4297-1; SAR-1) Avail: NTIS HC A03/MF A01

A novel corrosion protection technique is presented for the common solar collector metals: Al, Cu, and Fe as mild steel. The technique involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat exchanger tubes by application of a current in the presence of a suitable dissolved organic monomer. Tetramethylphenol (TMP) was shown to film Al/Zn samples, although complete coverage was not achieved. Copper and iron readily accommodate dimethylphenol and metaphenylenediamine as well as TMP films. As in the case of Al, holidays or cracks in the film were apparent thus precluding good corrosion protection. DOE

N80-15570# Midwest Research Inst., Golden, Colo.
SERAPH IMPLEMENTATION PLANS
 J. Castle, W. Su, D. A. Dougherty, and J. D. Wright May 1979 45 p refs
 (Contract EG-77-C-01-4042)
 (SERI/RR-34-152) Avail: NTIS HC A03/MF A01

The Solar Energy Research and Applications in Process Heat test facility (SERAPH) will provide the capability of addressing many of the technical issues that currently hamper industrial solar thermal energy system implementation. The initial capability of producing steam will be at a rate of 900 lb/h (410 kg/h) which corresponds to an energy delivery rate of 1.5 million Btu/h (1.6 x 10 to the 6th power) at 430 F (220 C) with expansion capability to approximately 600 F (315 C). The initial system controls will be analog with supervisory and direct digital control to follow. The issues to be addressed at SERAPH will be computer predictive model validation and refinement, control strategy development, solar equipment evaluation, and the accumulation of operating and maintenance experience. A consistent theme throughout the planning and operation of SERAPH is the need to develop and follow practices that are consistent with conventional industrial operating procedures. DOE

N80-15571# Midwest Research Inst., Golden, Colo.
ALTERNATE CYCLES APPLIED TO OCEAN THERMAL ENERGY CONVERSION
 B. Shelpuk and A. Lewandowski Feb. 1979 14 p refs Presented at the 11th Ann. Offshore Technol. Conf., Houston, Tex., 30 Apr. - 3 May 1979
 (Contract EG-77-C-01-4042)
 (SERI/TP-34-180: CONF-790444-3) Avail: NTIS HC A02/MF A01

Four open cycle OTEC concepts are described. These are: (1) single, vertical-axis turbine; (2) multiple, horizontal-axis turbine; (3) foam lift/hydraulic turbine; and (4) mist lift/hydraulic turbine. A preliminary assessment of achievable performance is made in addition to a description of the subsystem performance objectives which would support the achievement of the full potential inherent in these concepts. The results and conclusions include a description of the research objectives, achievement of which make open cycle OTEC a viable alternative as a national energy source. DOE

N80-15574# Sandia Labs., Albuquerque, N. Mex.
METHODOLOGY FOR DETERMINING THE CONFIGURATION OF THE OPTIMUM SOLAR TOTAL ENERGY SYSTEM
 R. R. Peters May 1979 59 p refs
 (Contract EY-76-C-04-0789)
 (SAND-79-0422) Avail: NTIS HC A04/MF A01

A methodology for determining the configuration of the most economical solar total energy system (STES) for a particular application is presented. The methodology is examined by using it to design a STES for a certain function. The results are presented and the sensitivity of the system design to changes in economic parameters, system location, and limits on the amount of purchased energy are discussed. A.W.H.

N80-15576# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1979
 Y. K. Ahn, R. J. Brumberg, H. C. Chen, E. T. Nelson, R. P. Stringer, and R. C. Bailie (Environmental Energy Engineering, Inc., Morgantown, W. Va.) 1979 23 p
 (Contract ET-78-C-02-5022)
 (COO-5022-5) Avail: NTIS HC A02/MF A01

The development of a linear programming model to determine the mix of biomass resources an conversion processes to produce fuel is summarized. A market analysis of the need for biomass derived fuel and the regional availability of biomass resources on seasonal bases is discussed. Biomass conversion profiles (gasification, pyrolysis, and direct combustion) are discussed for 100 biomass materials. The materials include wood species, bagasse, sugar cane, wheat, and rice straw. A.W.H.

N80-15577# Sandia Labs., Albuquerque, N. Mex.
DESIGN AND PERFORMANCE OF SILICON SOLAR CELLS UNDER CONCENTRATED SUNLIGHT
 H. T. Weaver and R. D. Nasby 1979 4 p refs Presented at the Intern. Solar Energy Soc. Meeting, Atlanta, 28 May 1979
 (Contract EY-76-C-04-0789)
 (SAND-79-1165C: CONF-790541-39) Avail: NTIS HC A02/MF A01

Measurements and numerical calculations of performance of silicon solar cells, designed for operation under concentrated sunlight, are presented. Two design strategies are discussed and data from cells of each type are used for comparison with theory. The calculations ignore degeneracy and high effects but include Auger and trap recombination. Experimental base lifetimes are used for modeling. DOE

N80-15578# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE US DEPARTMENT OF ENERGY PHOTO-VOLTAIC CONCENTRATOR DEVELOPMENT PROJECT
 B. D. Shafer, E. C. Boes, M. W. Edenburn, and D. G. Schueler 1979 8 p refs Presented at the 1979 Photovoltaic Solar Energy Conf., West Berlin, 23 Apr. 1979
 (Contract DE-AC04-76DP-00789)
 (SAND-78-2187C: CONF-790457-2) Avail: NTIS HC A02/MF A01

The development of a photovoltaic concentrator technology which results in low costs, long life photovoltaic arrays at a price of less than \$0.50 per peak watt is discussed. The development work in the areas of concentrator cells, concentrator modules, and complete arrays is surveyed. The various designs of the concentrator cells and concentrator modules are presented and evaluated in regard to their ability to produce cost effective energy. A.W.H.

N80-15582# New Mexico Univ., Albuquerque. Dept. of Economics.
DISTRICT SPACE HEATING POTENTIAL OF LOW TEMPERATURE HYDROTHERMAL GEOTHERMAL RESOURCES IN THE SOUTHWESTERN UNITED STATES
 P. K. McDevitt and C. R. Rao (New Mexico Energy Inst.) Oct. 1978 74 p refs Prepared jointly with New Mexico State Univ., Las Cruces
 (Contract EC-77-S-04-3992)
 (NMEI-10-1) Avail: NTIS HC A04/MF A01

A computer simulation model (GIROA-Nonelectric) developed to study the economics of district space heating using geothermal energy is described. GIROA-Nonelectric is a discounted cashflow investment model which evaluates the financial return on investment for space heating. The model consists of two major submodels: the exploration for and development of a geothermal anomaly by a geothermal producer, and the purchase of geothermal fluid by a district heating unit. A sensitivity analysis of the model subject to changes in physical and economic parameters is presented. The economic analysis and technological screening criteria are used to examine all the low temperature geothermal sites in Southwestern United States for economic viability for space heating application. DOE

N80-15583# Midwest Research Inst., Golden, Colo.
LOW TEMPERATURE THERMAL ENERGY STORAGE: A STATE-OF-THE-ART SURVEY
 F. Baylin Jul. 1979 120 p refs
 (Contract EG-77-C-01-4042)
 (SERI/RR-54-164) Avail: NTIS HC A06/MF A01

The preliminary version of an analysis of activities in research, development, and demonstration of low temperature thermal energy storage (TES) technologies having applications in renewable energy systems is presented. Three major categories of thermal storage devices are considered: sensible heat; phase change materials; and reversible thermochemical reactions. Both short-term and annual thermal energy storage technologies based on principles of sensible heat are discussed. Storage media considered are water, earth, and rocks. Annual storage technologies include solar ponds, aquifers, and large tanks or beds of water, earth, or rocks. All program processes from basic research through commercialization efforts are investigated. Nongovernment-funded industrial programs and foreign efforts are outlined

as well. Data describing low temperature TES activities are presented also as project descriptions. DOE

N80-15584# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.

MELTING IN PHASE-CHANGE THERMAL STORAGE MEDIA Final Report

E. M. Sparrow and J. W. Ramsey 1978 90 p refs (Contract EY-76-S-02-2993)

(COO-2993-1) Avail: NTIS HC A05/MF A01

Research on melting caused by a tubular heat source embedded in a solid phase-change medium is presented. Separate studies were performed with the heater positioned with its axis horizontal and with its axis vertical. Both orientations were investigated because they correspond to those of proposed bulk-type storage configurations. In addition, the direction of the gravity force relative to the heating surface is different in the two cases and this causes differences in the buoyancy forces that act on the liquid generated by the melting process. Two phase-change media were employed in the experiments: (1) the eutectic mixture of sodium nitrate and sodium hydroxide--melting temperature of 244 C; and (2) naphthalene--melting temperature of 80 C. The analysis was carried out on a specific fluid or a temperature level. The experimental results encompass information on both the heat transfer coefficient at the heated surface and on the size and shape of the melt zone. DOE

N80-15585# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.

EVALUATION OF THE EVACUATED SOLAR ANNULAR RECEIVERS USED AT THE MEDIUM-TEMPERATURE SOLAR SYSTEMS TEST FACILITY (MSSTF)

A. C. Ratzel Jul. 1979 56 p refs

(Contract EY-76-C-04-0789)

(SAND-78-0983) Avail: NTIS HC A04/MF A01

A parabolic cylindrical collector field subsystem used in tests to evaluate the vacuum integrity characteristics of ten glass to metal sealed concentric cylinder receivers is described. Tests and test results on the vacuum integrity and the collector system performance with evaluated receiver annuli and with receiver annuli maintained at atmospheric pressure are described. Heat loss reductions for different annulus gas pressures and under different receiver tube operating temperatures are presented. The collector's efficiency dependence upon operating temperature, annulus pressures, and insolation is discussed. A.W.H.

N80-15586# Higgins, Auld and Associates, Albuquerque, N. Mex. **ANALYSIS OF FIELD TEST RESULTS FOR SINGLE-AXIS-TRACKING SOLAR COLLECTOR FOUNDATIONS**

H. E. Auld Jul. 1979 36 p refs

(Contract EY-76-C-04-0789)

(SAND-79-7023) Avail: NTIS HC A03/MF A01

Five reinforced concrete cylindrical piers, typical of foundations utilized for single-axis-tracking solar collector systems, were tested to determine eccentric horizontal and vertical failure loads. The results from these tests were found to compare favorably with the results from theoretical calculations which incorporate the geotechnical parameters of the test site. Recommendations are made for the incorporation of these results into the design of foundations for future solar collector systems. DOE

N80-15588# Alabama Univ., University. Bureau of Engineering Research.

HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEMS DEVELOPMENT

W. J. Schaeztle and C. Everett Brett Mar. 1979 174 p refs Prepared for Argonne Natl. Lab., Ill.

(Contract W-31-109-eng-38)

(ANL/ICES-TM-30) Avail: NTIS HC A08/MF A01

The design, operation, economics, environmental impacts, and expected performance of heat pump centered integrated community energy systems are discussed in detail. DOE

N80-15589# Argonne National Lab., Ill. Energy and Environmental Systems Div.

HEAT PUMP CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT Interim Report

R. E. Crane (Franklin Res. Center), H. G. Lorsch (Franklin Res. Center), and R. G. Werden Feb. 1979 196 p refs

(Contract W-31-109-eng-38)

(ANL/ICES-TM-26) Avail: NTIS HC A09/MF A01

The concept of a heat pump centered integrated community energy system (HP-ICES) was explored based on a reference community located in the Northeast with a population of 10,000. Engineering and economic analyses were performed for the HP-ICES and for conventional heating/cooling systems. Sensitivity analyses were used to determine variations in results from changes in: community size; community energy density; waste heat utilization; energy cost escalation; maintenance and operating personnel; and central HP-ICES ownership. The effect of each of the critical parameters on the economic viability of HP-ICES is shown. Conditions of equal 20-year life cycle costs for HP-ICES and for conventional systems are given. DOE

N80-15590# Little (Arthur D.), Inc., Cambridge, Mass.

UTILIZATION OF WASTE HEAT FROM FEDERAL FACILITIES Final Report

Feb. 1979 182 p refs

(Contract EC-77-C-05-5523)

(ORO-5523-T1) Avail: NTIS HC A09/MF A01

The technical and economic feasibility of using waste heat from the Oak Ridge Gaseous Diffusion Plant (ORGDP), Paducah Plant, Portsmouth Gaseous Diffusion Plant (PFDP), and the Savannah River Plant (SRP) for industrial process heat, space heating, power generation, or in agriculture or aquaculture is evaluated. Recommended uses and the cost of implementing waste heat utilization near each site are discussed. The recommended uses at Oak Ridge include district heating, greenhouse heating, and heat pump enhanced temperature elevation of the ORGDP waste heat for subsequent process heat use in a textile mill. At Paducah, the recommendation is to use heat pumps to raise the waste heat temperature for preheating feedwater for a 1000 MW coal-fired power plant. At Portsmouth, greenhouse heating is recommended. At the SRP aquacultural and greenhouse, uses and utilization for power generation by means of a Rankine cycle process are recommended. DOE

N80-15591# Air Products and Chemicals, Inc., Allentown, Pa. **DEMONSTRATION OF A NITROGEN BASED CARBURIZING ATMOSPHERE: ENERGY CONSUMPTION OF THE ENDOTHERMIC GENERATOR Quarterly Report, 1 Oct. - 30 Dec. 1978**

R. J. Peartree Jan. 1979 22 p

(Contract EM-78-C-01-5058)

(CONS/5058-T1; QR-1; ID-12027-1)

Avail: NTIS

HC A02/MF A01

The energy consumption of an endothermic generator is documented. Two different sized generators were studied and found to have basically the same energy usage characteristics. The energy consumption was found to be dependent on generator output, with less energy consumption per unit volume at higher outputs. DOE

N80-15592# Department of Energy, Washington, D. C. Energy Information Administration.

THE 1985, 1990 AND 1995 MIDTERM ENERGY MARKET MODEL RESULTS UNDER THREE SCENARIOS OF FUEL USE ACT REGULATIONS

W. D. Montgomery, III May 1979 621 p refs

(DOE/EIA-0182/2) Avail: NTIS HC A99/MF A01

The incremental impacts of the Powerplant and Industrial Fuel Use Act regulations are analyzed as a function of the stringency of the economic test under which exemptions are granted. To carry out this analysis, the Mid-Term Energy Market Model (MEMM) is used to generate projections of energy supply, demand, and price under the specified assumptions. Industrial fuel demand is modeled by using a separate fuel-choice model to determine the share of oil, gas, and coal; these shares are

then imposed on the MEMM solution. For electric utilities, impacts are modeled by altering the capital costs in the MEMM submodel. Preliminary numerical results of some of the model runs are presented. DOE

N80-15593# Department of Energy, Washington, D. C. Energy Information Administration.

ENERGY SUPPLY AND DEMAND IN THE SHORT TERM: 1979 AND 1980

Jun. 1979 127 p refs

(DOE/EIA-0184/4) Avail: NTIS HC A07/MF A01

Overall energy supply and demand balances as well as a detailed discussion of the elements of end-use consumption of coal, natural gas, petroleum products, and electricity are presented. Analyses of the operations of utilities and refineries, the domestic production of coal, natural gas, crude oil, and electricity, and the supply and demand balances for each fuel are provided. Projections of domestic production as well as supply and demand balances, synthetics and imports, and projections for the electric utility sector are included for the short-term. DOE

N80-15594# Department of Energy, Washington, D. C. International Energy Analysis Div.

INTERNATIONAL ENERGY ASSESSMENT Analysis Report

W. C. Kilgore May 1979 74 p refs

(DOE/EIA-0184/1; AR/IA/79-27) Avail: NTIS HC A04/MF A01

A comprehensive assessment of the international energy situation between now and the year 1995 is given. Forecasts of energy supply and demand for each region of the world are included along with estimates of future world oil prices and a sensitivity analysis of the critical factors affecting those prices. The analysis projects that world energy consumption will rise at a rate of between 2.8 and 3.9% per year, over the forecast period, while the demand for petroleum is expected to grow at a rate of 2.0 to 3.5% per year. This growth in consumption is projected to occur during a period in which world economic activity is increasing at the rate of 3.8 to 4.6% per year, such that the estimated ratio of world energy growth to economic growth falls from its historic 1960-1976 ratio of 0.94, to a ratio of 0.71 to 0.85 over the 1976-1995 period. World oil prices are found to be highly uncertain with real prices by 1995 ranging between \$16.50 and \$31.50 per barrel across five projection series. DOE

N80-15595# Illinois Univ., Urbana. Office of Vice Chancellor for Research.

ENERGY OPTIMAL USE OF WASTE PAPER Final Report

T. L. Gunn Nov. 1978 188 p refs

(Contract EY-76-S-02-2893)

(COO-2893-9) Avail: NTIS HC A09/MF A01

The mix of burning and recycling of waste paper that would minimize the total US energy used to make and dispose of the 1974 production of paper is assessed. Five cases are analyzed to determine the effects of various assumptions about how the energy in wood and paper will be treated. In one case, both wood and paper are assumed to have an energy value. In another, neither wood nor paper is assumed to have an energy value. In the other three cases, paper, but not wood, is assumed to have an energy value which is utilized differently in each case. It is found in each case that it is worthwhile in terms of energy conservation to recycle as much high grade de-inking waste paper as can be collected. How much of the other grades of waste paper would be recycled depends on which of the various energy accounting schemes is used. It is further found that the greatest energy savings are accomplished when both wood and waste paper are acknowledged to have an energy value. DOE

N80-15596# Acres American, Inc., Buffalo, N. Y. **FEASIBILITY OF COMPRESSED AIR ENERGY STORAGE AS A PEAK SHAVING TECHNIQUE IN CALIFORNIA, VOLUME 2 Final Report**

Sep. 1978 523 p refs

(Contract EY-76-C-03-1331)

(SAN-1331-T1) Avail: NTIS HC A22/MF A01

The technical, economic, and siting feasibility, on a preliminary basis, of the use of compressed air energy storage in the state of California was investigated. The analysis was performed on a parametric basis using gas turbines and combined cycle plants as a comparison. The methodology, base data, and results are presented along with the computer program used. The design sites for porous media and compensated hard rock are documented along with an alternate site for each type of plant and the plant designs for porous media and hard rock storage. Developments in gas turbine generators and CAES plant designs are projected as both technologies are expected to advance in the near term. Cost estimates and construction schedules prepared for the plant designs are presented. Results and conclusions are given. DOE

N80-15597# Institute of Gas Technology, Chicago, Ill. **APPLICATION ANALYSIS OF SOLAR TOTAL ENERGY SYSTEMS TO THE RESIDENTIAL SECTOR. VOLUME 4: MARKET PENETRATION Final Report**

Jul. 1979 320 p refs

(Contract EG-77-C-04-3787; Proj. 8987)

(ALO-3787-4) Avail: NTIS HC A15/MF A01

The residential consumption of energy in each of the 11 solar total energy systems (STES) regions is given by fuel type and end-use category. The current and projected costs and availability of fossil fuels and electricity for the STES regions are reported. Projections are made concerning residential building construction and the potential market for residential STES. The effects of STES ownership options, institutional constraints, and possible government actions on market penetration potential are considered. Capital costs for two types of STES are determined, those based on organic Rankine cycle (ORC) heat engines and those based on flat plate, water-cooled photovoltaic arrays. Both types of systems utilize parabolic trough collectors. The capital cost differential between conventional and STE systems is calculated on an incremental cost per dwelling unit for comparison with projected fuel savings in the market penetration analysis. Results of a market analysis are summarized. DOE

N80-15598# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.

NATIONAL PROGRAM PLAN FOR PASSIVE AND HYBRID SOLAR HEATING AND COOLING Interim Report

Jun. 1979 131 p

(DOE/CS-0089) Avail: NTIS HC A07/MF A01

A definition of a passive solar system is given, as well as background of Federal involvement in passive solar heating and cooling, program goals and objectives, and an overall implementation approach. Background information on the status of and the strategy and emphasis for technology development is provided, followed by descriptions of passive heating and passive cooling systems and an overview of task classifications for technology development. The technology utilization program is also presented. DOE

N80-15599# Utah Univ., Salt Lake City.

CONFERENCE ON PERFORMANCE MONITORING TECHNIQUES FOR EVALUATION OF SOLAR HEATING AND COOLING SYSTEMS

1978 353 p refs Conf. held in Washington, D.C., 3 Apr. 1978

(Contract EG-77-S-04-4094)

(CONF-780432) Avail: NTIS HC A16/MF A01

A general review of solar energy monitoring systems, their relationship to data users and their needs, and a methodology for developing instrumentation systems and performance evaluation techniques based on a systematic procedure for addressing the actual needs of the data user are provided. DOE

N80-15600# Sandia Labs., Albuquerque, N. Mex. Solar Technical Liaison Div.

DYNAMIC STORAGE IN SOLAR TOTAL ENERGY PROGRAMS

R. P. Stromberg 1978 27 p refs Presented at the Seminar on Solar Energy Storage, Trieste, Italy, 4 Sep. 1978

(Contract EY-76-C-04-0789)

(SAND-78-0958C; CONF-780944-1) Avail: NTIS
HC A03/MF A01

A program of research and development to establish the feasibility of the Solar Total Energy Concept is described. The major items of actual hardware are a 32 kW Midtemperature Solar Systems Test Facility at Albuquerque, NM; and two planned Large Scale Experiments at Shenandoah, GA, and Ft. Hood, TX. These programs are described with reference to current literature. DOE

N80-15601# Sandia Labs., Albuquerque, N. Mex.
**DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL
POWER SYSTEMS SEMI-ANNUAL REVIEW**

Nov. 1978 305 p refs Conf. held at Dallas, 19-21 Sep. 1978

(Contract EY-76-C-04-0789)

(SAND-78-8511) Avail: NTIS HC A14/MF A01

Progress in the development of large solar power systems is reported. Hydraulic stability of solar boilers, closed cycle Brayton solar thermal electric power plants, heliostat development, and central receiver systems are discussed along with distributed collectors and total energy and hybrid systems. J.M.S.

N80-15602# Sandia Labs., Albuquerque, N. Mex.
**DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL
POWER SYSTEMS SEMI-ANNUAL REVIEW**

May 1978 262 p refs Conf. held at Reston, Va., 21-22 Mar. 1978

(Contract EY-76-C-04-0789)

(SAND-79-8508) Avail: NTIS HC A12/MF A01

Thirty papers are presented each discussing various aspects of the large solar central power systems program. R.E.S.

N80-15604# Ohio State Univ., Columbus. Engineering
Experiment Station.

FUEL UTILIZATION IN RESIDENCES

C. Sepsy, M. F. McBride, R. S. Blanchett, and C. D. Jones
Sep. 1978 251 p Presented at ASHRAE, Philadelphia,
28 Jan. - 1 Feb. 1979

(EPRI Proj. 137-1)

(EPRI-EA-894) Avail: NTIS HC A12/MF A01

A mathematical model and digital computer program were developed for accurately calculating the energy required by residential housing units on an hourly, daily, monthly, and seasonal basis. The model and program were used to establish an accurate procedure for determining the monthly and seasonal energy requirements of all types of residential structures. The response-factor technique was used to calculate the dynamic load responses of a residential structure. The model and program take into account all the internal and external dynamic loads imposed on the structure; they were verified by extensive calculations and field measurements applied to nine residential dwelling units in the Columbus, Ohio, area. All contained conventional space heating and cooling equipment, either natural gas or electric forced-air furnaces. A dynamic model for simulating hourly attic space air temperatures was developed and incorporated in the thermal-load calculation procedures. DOE

N80-15605# Department of Energy, Washington, D. C.
NUCLEAR STRATEGY OF THE DEPARTMENT OF ENERGY
Apr. 1979 89 p

(DOE/ER-0025/D) Avail: NTIS HC A05/MF A01

An analysis of the technical and economic parameters related to the timing and future deployment of nuclear power is presented. A set of alternative nuclear strategies are presented and evaluated. The strategies involve decisions on breeder commercialization, fuel cycle development, and strengthening the nuclear option. A.W.H.

N80-15606# Wharton (E. F. A.), Inc., Philadelphia, Pa.
**WHARTON ANNUAL ENERGY MODEL: DEVELOPMENT
AND SIMULATION RESULTS Final Report**

W. Finan and G. R. Schink Jul. 1979 93 p refs
(EPRI Proj. 440-1)

(EPRI-EA-1115) Avail: NTIS HC A05/MF A01

The energy sector of a commercially available macroeconomic model was expanded in order to develop a tool for examining future energy-economy interactions. The specific methodologies employed are described and a set of energy policy simulations using the newly expanded model is presented. DOE

N80-15609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
**FLYWHEEL ENERGY STORAGE INTERFACE UNIT FOR
PHOTOVOLTAIC APPLICATIONS**

A. R. Millner and R. D. Hay 1979 6 p refs Presented at
the Intersociety Energy Conf., Boston 5 Aug. 1979

(Contract EY-76-C-02-4094)

(COO-4094-44; CONF-790803-42) Avail: NTIS
HC A02/MF A01

The design of a flywheel energy storage and conversion system is presented. The system which will serve as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage is evaluated. Features of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. A preliminary economic analysis is provided. DOE

N80-15611# Argonne National Lab., Ill. Chemical Engineering
Div.

**LITHIUM/IRON SULFIDE BATTERIES FOR ELECTRIC
VEHICLES**

P. A. Nelson, A. A. Chilenskas, and R. K. Steunenberg 1978
24 p refs Presented at the 5th Intern. Electric Vehicle Symp.,
Philadelphia, 2-5 Oct. 1978

(Contract W-31-109-eng-38)

(CONF-781006-2) Avail: NTIS HC A02/MF A01

Recent progress in the development of LiAl/FeS/sub x/ batteries for electric vehicles is assessed. The possibility of near-term commercialization of a version of the battery that utilizes monosulfide (FeS) positive electrodes in conjunction with low cost, iron alloy current collectors is indicated. Multiple-electrode cells having a specific energy of about 100 Wh/kg are now under test. Conceptual design problems for a compact insulating jacket, which will maintain the battery temperature at 450 C, appear to be solved. Work is also underway on a version of the battery that would utilize FeS₂ positive electrodes, which use molybdenum current collectors at present and may require the future development of less expensive current collectors to be commercially attractive. These batteries would ultimately have about 30 to 40% higher specific energy and 50 to 75% higher specific power than the FeS-type batteries. DOE

N80-15612# California Univ., Livermore. Lawrence Livermore
Lab.

LAMINATED DISK FLYWHEEL PROGRAM

Richard G. Stone 24 Oct. 1978 9 p refs Presented at the
Inform. Exchange Conf., Luray, Va., 24 Oct. 1978

(Contract W-7405-eng-48)

(UCRL-81772; CONF-781046-4) Avail: NTIS
HC A02/MF A01

A program to develop the technology for high energy density, fiber composite flywheels based on the laminated disk concept is described. Progress toward optimizing the flywheel energy system with respect to low volume, low weight, manufacturability, and economy is reported. Program planning areas including the manufacturing of test model flywheels and developing a hub attachment are discussed. A.W.H.

N80-15613# Institute of Gas Technology, Chicago, Ill.
**PREDICTION OF CURRENT DISTRIBUTION IN A MOLTEN
CARBONATE FUEL CELL**

V. Sampath, J. R. Selman, and A. F. Sammells 1978 30 p
refs Presented at the 2d Intern. Symp. on Molten Salts, Pittsburgh,
15-20 Oct. 1978; Sponsored by the Electrochem. Soc., Inc.

(Contract EM-78-C-03-1735)

(CONF-781063-1) Avail: NTIS HC A03/MF A01

A mathematical model was developed to predict the performance of a molten carbonate fuel cell as a function of anode and cathode gas compositions, gas flow rates, and polarization characteristics. The effect of gas flow modes such as crossflow and coflow and the effect of higher pressures on

the current distribution were studied. The predicted polarization curves agree well with the experimentally generated polarization curves. Conditions for incorporating a microscopic porous electrode model into the overall model development are briefly outlined.

DOE

N80-15614# Argonne National Lab., Ill.
DEVELOPMENT OF Li-Al/FeS CELLS WITH LiCl-RICH ELECTROLYTE

F. J. Martino, L. G. Bartholme, E. C. Gay, and H. Shimotake 1978 15 p refs Presented at the Symp. on Battery Design and Optimization, Pittsburgh, 15-20 Oct. 1978 (Contract W-31-109-eng-38)

(CONF-7810135-2) Avail: NTIS HC A02/MF A01

Rechargeable lithium-aluminum/iron sulfide cells using the LiCl-KCl eutectic (44 wt % LiCl) electrolyte were developed. The utilization of these cells at high discharge rates was hindered by the formation of J phase LiKFeS₂6Cl in the FeS electrodes. To overcome this problem, four engineering size cells (approximately 100 Ah theoretical capacity) were built with LiCl-rich electrolyte (54 wt % LiCl). At the 4-h rate, the utilization of these cells was improved by more than 40% over that of cells containing the eutectic electrolyte.

DOE

N80-15615# Department of Energy, Washington, D. C.
ALL-UNION SCIENTIFIC AND TECHNICAL CONFERENCE ON USE OF THE EARTH'S HEAT FOR THE PRODUCTION OF ELECTRIC POWER - SUMMARY OF REPORTS

Oct. 1978 138 p refs Transl. into ENGLISH of Vsesoyuznoye Nauchno-Tekhnicheskoye Soveshchaniye. Ispol'zovaniye tepla zemli dlya Proizvodstva Elektroenergii (Tezisy Dokladov), USSR Ministry of Power and Electrification, 1975 186 p Conf. held at Moscow, 10-14 Dec. 1975

(CONF-751270-Summ) Avail: NTIS HC A07/MF A01

The use and effectiveness of geothermal energy for producing electric power is discussed. Topics include the operation of geothermal electric stations and power plants, systems for the extraction of heat from the Earth's crust, drilling of geological prospecting boreholes for steam, and geophysical methods for monitoring the parameters of underground heat boilers. A.W.H.

N80-15616# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

PERFORMANCE OF RESIDENTIAL SOLAR HEATING AND COOLING SYSTEM WITH FLAT-PLATE AND EVACUATED TUBULAR COLLECTORS: CSU SOLAR HOUSE 1

W. S. Duff, T. M. Conway, G. O. G. Loef, D. B. Meredith, and R. B. Pratt 1978 14 p refs Presented at the CCMS Meeting, Dusseldorf, W. Germany, 19 Apr. 1978

(Contract EY-76-S-02-2577)

(COO-2577-17; CONF-7804101-1)

Avail: NTIS

HC A02/MF A01

Performance data were procured on 47 days during operation of the flat plate collector and on 112 days when the house was heated or cooled by the evacuated tube collector system. It was concluded that the system comprising an evacuated tubular collector, lithium bromide absorption water chiller, and associated equipment is highly effective in providing space heating and cooling to a small building, that it can supply up to twice the space heating and several times the cooling obtainable from an equal occupied area of good quality flat plate collectors, and that a greater fraction of the the domestic hot water can be obtained by supplying its heat from main storage. A summary of monthly and annual energy use for space heating, domestic hot water heating, and space cooling is presented.

DOE

N80-15618# California Univ., Berkeley. Lawrence Berkeley Lab.

AQUIFER THERMAL ENERGY STORAGE

C. F. Tsang 1978 27 p refs Presented at the Symp. on Advanced Technol. for Storing Energy, Chicago, 10 Jul. 1978 (Contract W-7405-eng-48)

(LBL-7070; CONF-780714-2) Avail: NTIS HC A03/MF A01

The concept of thermal energy storage is examined through the storage of waste hot water from power plants or from solar energy collectors in aquifers. The hydrodynamic and thermal behaviors of the storage system are analyzed and illustrated. A

computer model developed to study the physical conditions and parameters and to make realistic predictions of the energy storage and retrieval efficiencies is described.

A.W.H.

N80-15619# Oak Ridge National Lab., Tenn.
INTERMEDIATE REPORT ON THE PERFORMANCE OF PLATE-TYPE ICE-MAKER HEAT PUMPS Progress Report

V. D. Baxter Oct. 1978 43 p refs

(Contract W-7405-eng-26)

(ORNL/CON-23) Avail: NTIS HC A03/MF A01

Two ice maker heat pumps were tested and compared for the effect of harvesting scheme and evaporator plate loading on performance in both water chilling and ice making modes. The systems design of each heat pump is reported with two major differences, the type of harvest scheme employed and the evaporator and compressor size, examined for efficiency and relative performance. The effect of thermostatic type cyclic operation on performance of the pumps is investigated. A.W.H.

N80-15620# Oak Ridge National Lab., Tenn. Engineering Technology Div.

CHARACTERIZATION OF OPERATING CONDITIONS FOR GAS/WATER HEAT RECOVERY STEAM GENERATORS

R. L. Graves 13 Oct. 1978 21 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6622) Avail: NTIS HC A02/MF A01

The possible operating points of air/water and helium/water steam generators are parametrically presented. Calculation procedures and a sample computer program listing are provided. Multiple saturated steam conditions are shown to be attainable with the same gas inlet and exit temperatures. Design considerations of heat transfer surface area and pumping requirements are also discussed.

DOE

N80-15621# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN OCEAN THERMAL ENERGY CONVERSION

Aug. 1979 53 p

(DOE/EDP-0034) Avail: NTIS HC A04/MF A01

The present status and goals of the OTEC program are described, and potential environmental, health, safety, and socioeconomic impacts relevant to the program are identified. A management plan is presented for conducting and coordinating environmental research in concert with the development of appropriate technology. Five major classes of environmental concerns associated with the deployment and operation of an OTEC system are discussed. They are changes in oceanic properties, chemical pollution, operation of a manned platform, legal and institutional matters, and secondary impacts associated with site selection, construction, and operation of OTEC plants.

DOE

N80-15622# Oklahoma Univ., Norman.
CRITICAL SPEEDS AND NATURAL FREQUENCIES OF RIM-TYPE COMPOSITE-MATERIAL FLYWHEELS

C. W. Bert, T. L. C. Chen, and C. A. Kocay Sep. 1978 108 p refs

(Contract EY-76-C-04-0789)

(SAND-78-7049) Avail: NTIS HC A06/MF A01

An analytical investigation conducted on a 0.56 kWh composite material flywheel energy storage system for application in hybrid automotive vehicles is reported. The investigation calculated the critical speeds and natural frequencies of a rim type flywheel which is flexibly mounted on a finite hub, which in turn, is attached to an elastic shaft. The specific modes covered include whirling, torsional, and axial modes involving band, shaft and support flexibilities and in-plane bending, combined out of plane bending/twisting, and extensional modes of the flywheel rim. The phenomena occurring during acceleration through critical speeds and the effect of creep stress relaxation on the supporting bands are examined.

DOE

N80-15623# Sandia Labs., Albuquerque, N. Mex.
OVERVIEW OF FLYWHEEL ENERGY STORAGE COMPONENT DEVELOPMENT

R. O. Woods [1978] 7 p refs Presented at 1st Inform. Exchange Conf., Luray, Va. 24 Oct. 1978 (Contract EY-76-C-04-0789) (SAND-78-1999C; CONF-781046-8) Avail: NTIS HC A02/MF A01

Composite flywheel design, bearings, shaft seals, and general vacuum technology are reviewed. K.L.

N80-15624# Sandia Labs., Albuquerque, N. Mex.

SANDIA COMPOSITE-RIM FLYWHEEL DEVELOPMENT

E. D. Reedy, Jr. [1978] 13 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978 (Contract EY-76-C-04-0789)

(SAND-78-1865C; CONF-781046-3) Avail: NTIS HC A02/MF A01

A series of flywheel spin tests and the status of the rotor development program are discussed. Two designs incorporating a 20 in. OD graphite/epoxy rim were tested. Each design utilized a different method of attaching the rim to an aluminum hub with Kevlar 49/epoxy bands. Data on rotor performance, dynamics, and failure modes are presented. DOE

N80-15625# Oak Ridge National Lab., Tenn.

ANALYSIS OF POTENTIAL IMPLEMENTATION LEVELS FOR WASTE HEAT UTILIZATION IN THE NUCLEAR POWER INDUSTRY

M. Olszewski and H. R. Bigelow Oct. 1978 34 p refs (Contract W-7405-eng-26)

(ORN/TM-63-2) Avail: NTIS HC A03/MF A01

An assessment of land available at nuclear power stations was performed in an effort to determine the limitations land availability would impose on the implementation of reject heat utilization systems. A waste heat utilization factor was defined for all operating and planned nuclear power stations. This factor is the percentage of the station's reject heat that could be utilized on the land available for such use at the site. An estimate of the potential for implementation at fossil stations was performed. DOE

N80-15626# California Univ., Livermore. Lawrence Livermore Lab.

ENVIRONMENTAL OVERVIEW OF GEOTHERMAL DEVELOPMENT: THE GEYSERS-CALISTOGA KGRA. VOLUME 1: ISSUES AND RECOMMENDATIONS

D. L. Ermak and P. L. Phelps 4 Oct. 1978 21 p refs (Contract W-7405-eng-48)

(UCRL-52496-Vol-1) Avail: NTIS HC A02/MF A01

Priorities of the impacts of geothermal resource development on local communities and environments are assessed and recommendations are given particularly in the hydrogen sulfide emissions from the geysers steam evolved. Other high priority needs are related to controlling noise from geothermal development, land-use conflicts between geothermal and other potential uses, impacts from landslide and soil erosion induced by geothermal development and protection of rare and endangered species in the region. DOE

N80-15627# Sandia Labs., Albuquerque, N. Mex.

PULSAR: AN INDUCTIVE PULSE POWER SOURCE

E. C. Cnare, W. P. Brooks, and M. Cowan 1979 4 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979

(Contract EY-76-C-04-0789)

(SAND-79-1246C; CONF-790622-19) Avail: NTIS HC A02/MF A01

The pulsar concept of inductive pulsed power source which uses a flux compressing metallic or plasma armature rather than a fast opening switch to transfer magnetic flux to a load is discussed. The inductive store is a relatively unsophisticated dc superconducting magnet. The development of much faster plasma armatures for use in larger systems of one and two meters diameter is examined. Techniques used to generate the required high magnetic Reynolds number flow are described. DOE

N80-15628# Hawaii Univ. at Manoa, Honolulu. Hawaii Natural Energy Inst.

SOLAR/WIND HANDBOOK FOR HAWAII: TECHNICAL APPLICATIONS FOR HAWAII, THE PACIFIC BASIN AND SITES WORLDWIDE WITH SIMILAR CLIMATIC CONDITIONS

W. Falicoff, G. Koide, and P. Takahashi May 1979 647 p refs Prepared jointly with Hawaii Univ., Hilo and Hawaii State Dept. of Planning and Economic Development (Contract W-7405-eng-48) (UCRL-15053) Avail: NTIS HC A99/MF A01

The techniques are presented for using solar energy and wind power in applications such as domestic hot water production, space cooling, process heating, and power generation. The findings and information are based upon conditions in Hawaii, but can apply to locations with similar environments such as the entire Pacific area. DOE

N80-15629# Argonne National Lab., Ill.

TURBOMACHINERY OPTIONS FOR AN UNDERGROUND PUMPED HYDROELECTRIC STORAGE PLANT

C. A. Blomquist, S. W. Tam, and A. A. Frigo 1979 11 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979

(Contract W-31-109-eng-38)

(CONF-790803-50) Avail: NTIS HC A02/MF A01

Various turbomachinery options for underground pumped hydroelectric storage (UPHS) plants are reviewed. Current technology indicates that the maximum head for single-stage, reversible, Francis-type pump turbines is 625 m; for separate, single-stage, Francis-type turbines and multistage pumps, 672 m; for tandem units consisting of separate multijet impulse turbines and multistage pumps, 1440 m; and for multistage, reversible, ungated Francis-type pump turbines, 1290 m. Engineering design studies indicate that heads for the single-stage reversible units could be extended to 1000 m, developing 500 MW output per unit. The studies also indicate that two stage, reversible, Francis-type pump turbines with adjustable wicket gates could be developed for power outputs up to 500 MW at operating heads as high as 1500 m. DOE

N80-15630# Department of Energy, Washington, D. C. Office of Consumption Data System.

FEDERAL ENERGY DATA SYSTEM (FEDS) STATISTICAL SUMMARY UPDATE

J. P. Galliker Jul. 1979 854 p

(DOE/EIA-0192) Avail: NTIS HC A99/MF A01

The Federal energy data system statistical summary update displays state level energy consumption by major economic sectors for the years 1960 to 1977. The data are displayed in both calorific units and physical units. Fuels are divided into categories, i.e., highway gasoline in the transportation sector; kerosene in the residential sector; coking coal and petroleum coke in the industrial sector; and diesel in the transportation sector. DOE

N80-15631# Department of Energy, Washington, D. C. International Energy Analysis Div.

ENERGY DEMAND IN THE DEVELOPING COUNTRIES

J. Child and Mark Hodek Apr. 1979 20 p refs

(DOE/EIA-0183/10) Avail: NTIS HC A02/MF A01

An analysis of the demand for energy in developing countries is summarized. A model of developing country energy demand which is econometric in nature and is designed to forecast demand for oil, coal, and natural gas - excluding non-fossil fuels is described. The model and data used in the analysis are defined, and results generated with the 1978 model and the 1977 model based on identical sets of assumptions are compared. DOE

N80-15633# SRI International Corp., Menlo Park, Calif.

ECONOMIC IMPACTS OF ENERGY CONSERVATION AND RENEWABLE ENERGY SOURCES

R. C. Carlson 1979 21 p refs

(Contract W-7405-eng-48)

(UCRL-15087) Avail: NTIS HC A02/MF A01

An overall theory of the economic impacts of alternative energy developments is developed. Literature on such impacts is reviewed and economic impacts of alternative energy development scenarios for California are projected. Economic impacts include changes in aggregate employment, unemployment, real

income, and real output. Changes in each of these measures are analyzed in circumstances that include incentives or mandates for increased energy conservation or use of renewable energy resources. DOE

N80-15634# Brookhaven National Lab., Upton, N. Y.
MARKAL: A MULTIPERIOD LINEAR-PROGRAMMING MODEL FOR ENERGY SYSTEMS ANALYSIS (BNL VERSION)

H. Abilock, C. Bergstrom, J. Brady et al 1979 23 p refs
 Presented at the Energy Systems Analysis Intern. Conf., Dublin, 9 Oct. 1979
 (Contract EY-76-C-02-0016)
 (BNL-26390; CONF-791007-3) Avail: NTIS
 HC A02/MF A01

A computer program, MARKAL, a demand-driven, multiperiod, LP model of energy supplies and demands, is described. Its intended application is at the level of an entire nation. MARKAL takes exogenously supplied energy-demand figures and determines the optimal energy-supply and end-use-device network that can meet the demand. The computer systems design and requirements are discussed. The use of MARKAL for assessing the merits of energy technologies and characterizing their likely technological and economic characteristics is examined. DOE

N80-15635# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS

A. R. Millner 1979 15 p Presented at the Intern. Assembly on Energy Storage, Dubrovnik, Yugoslavia, 27 May 1979
 (Contract EY-76-C-02-4094)
 (COO-4094-48; CONF-790515-4) Avail: NTIS
 HC A02/MF A01

The design of a flywheel energy storage and conversion system is examined. The system serves as an interface between a solar photovoltaic array and an ac load, providing output waveform regulation as well as energy storage. Characteristics of the system include magnetic bearings, an ironless armature motor generator, and a low cost flywheel rotor. An economic analysis is presented. DOE

N80-15637# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.

SOLAR MECHANICAL ENERGY STORAGE PROGRAM OVERVIEW AND SYSTEMS ANALYSIS RESULTS

B. C. Caskey 1979 6 p refs Presented at the Mechanical and Mag. Energy Storage Contractor, Washington, D.C., 19 Aug. 1979
 (Contract EY-76-C-04-0789)
 (SAND-79-1642C; CONF-790854-1) Avail: NTIS
 HC A02/MF A01

The mechanical energy storage modes that are used in conjunction with solar inputs supplying small to intermediate loads are evaluated. Energy storage systems considered are flywheels, a pneumatic energy storage system, and low head pumped hydro storage. The development of low cost stationary flywheel technology is discussed. A computer program for systems analysis of the energy storage systems is described which uses economic parameters, system size, collector output and load demand based on hourly weather data for input data. A.W.H.

N80-15638# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESCRIPTION OF THE MIT/LINCOLN LABORATORY PHOTOVOLTAIC SYSTEMS TEST FACILITY

S. B. Sacco 30 Jun. 1979 25 p ref
 (Contract EY-76-C-02-4094)
 (COO-4094-41) Avail: NTIS HC A02/MF A01

The test facility and the mechanical and electrical interfaces for items to be tested are described. These interfaces include those for the solar array, batteries, inverters, and for backup dc power sources. Permanent power and instrumentation wiring at the facility are depicted in sufficient detail to permit test plans to be drawn up from these descriptions. DOE

N80-15639# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

ROLE OF THE GOVERNMENT IN THE DEVELOPMENT OF SOLAR ENERGY

M. D. Yokell 1979 29 p refs Presented at the Ann. Meeting Assoc. for the Advan. of Sci., Houston, Tex., 4 Jan. 1979
 (Contract EG-77-C-01-4042)
 (SERI/TP-52-138; CONF-790122-3) Avail: NTIS
 HC A03/MF A01

The economic rationale for a Federal solar energy subsidy program, the type of program required, and methods for determining the proper funding level for each program are discussed. An introduction offers a brief description of solar technologies. A summary of the current Federal solar subsidy program is also provided. DOE

N80-15640# Department of Energy, Washington, D. C. Office of Leasing Policy Development.

FEDERAL LEASING AND OUTER CONTINENTAL SHELF ENERGY PRODUCTION GOALS

Jun. 1979 426 p refs
 (DOE/RA-0037) Avail: NTIS HC A19/MF A01

The growing U.S. dependence on foreign energy sources, coupled with a limited mid-term supply of newer energy sources, has focused national energy policy on expanding domestic production of fossil fuels. Considering that up to 60 percent of the nation's undiscovered energy resources may be located on the Outer Continental Shelf (OCS) and that new opportunities exist for redirecting Federal management of OCS lands, the energy potential of the OCS was assessed. Oil and natural gas production goals for the OCS were established and are presented. The goals were determined by adding the production from existing OCS leases and estimated production from lease sales appearing on proposed lease schedules. R.E.S.

N80-15641# Sandia Labs., Albuquerque, N. Mex. System Analysis Div.

SOLAR ENHANCED OIL RECOVERY: AN ASSESSMENT OF ECONOMIC FEASIBILITY

K. D. Bergeron May 1979 51 p refs
 (Contract EY-76-C-04-0789)
 (SAND-79-0787) HC A04/MF A01

An assessment of the potential economic viability of solar enhanced oil recovery (EOH) is presented. The technical and physical aspects of the merging of solar energy with EOR are examined. A cost model of the system based on a number of assumptions including operating lifetime, nonsteam costs, tax credits, and fuel prices is presented. A.W.H.

N80-15642# Electric Power Research Inst., Palo Alto, Calif. Fossil Fuel and Advanced Systems Div.

FEASIBILITY STUDY FOR ENHANCING THE DEVELOPMENT OF FUSION ENERGY

N. A. Amherd, ed. and J. H. Vanston, ed. Mar. 1979 158 p refs
 (EPRI-ER-778-SR) Avail: NTIS HC A08/MF A01

Areas of work, as well as contributions to fusion program planning are presented. The feasibility of a comprehensive project addressing programmatic issues was investigated. A historical examination of the commercial development of selected large scale technologies, together with the specification of the methods for examining the compatibility of the fusion program with the electric utilities needs, and a plan for a detailed study of the safety and environmental issues of fusion power is given. Summaries of interviews with several people who have played key roles in the management of high technology development programs are reported. R.C.T.

N80-15643# Los Alamos Scientific Lab., N. Mex.
WATER USE ALTERNATIVES FOR NAVAJO ENERGY PRODUCTION

D. Abbey 1979 17 p refs Presented at the Navajo Energy and Environ. Technol. Training Conf., Tsaile, Ariz., 30 May 1979
 (Contract W-7405-eng-36)
 (LA-UR-79-1598; CONF-790550-3) Avail: NTIS
 HC A02/MF A01

The technologies and estimate costs (\$/af saved) for those activities for which water conservation is feasible are described. The range of water requirements compared to energy and water resource estimates, alternative criteria for energy and water resource management are discussed: (1) promote energy activities with the lowest minimum water requirements; (2) require industry to use low quality water resources and the most effective water conservation technology; and (3) maximize the economic return on Navajo water resources (\$/af consumed). DOE

N80-15645# New Mexico Energy Inst., Las Cruces.
USE OF GEOTHERMAL ENERGY FOR DESALINATION IN NEW MEXICO: A FEASIBILITY STUDY Final Report, 7 Jan. 1977 - 30 May 1979

Lokesh Chaturvedi, Conrad G. Keyes, Jr., Chandler A. Swanberg, Yash P. Gupta, Marion Michael Hightower, and Ray Jay Davis (Arizona Univ.) Jun. 1979 142 p refs
 (PB-299271/7; NMEI-42) Avail: NTIS HC A07/MF A01 CSCL 07C

The availability versus the requirements of water in the New Mexico area is examined. The use of geothermal energy for the desalinization of water in order to increase the water supply to the area is studied. Geothermal desalinization technology is reported along with potential geothermal desalinization sites. Saline and geothermal aquifer well fields design are described. Environmental, legal, and institutional considerations are outlined. A.W.H.

N80-15648# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAM AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Apr. - Jun. 1979

W. J. Toth, R. W. Henderson, W. F. Barron, A. C. Goodman, and C. S. Leffel, Jr. Jul. 1979 46 p refs
 (PB-310245/7; APL/JHU/EQR-79-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Topic areas covered include: geothermal energy development planning, hydroelectric power development, energy conversion and storage techniques, power plant site evaluation, and ocean thermal energy conversion development. GRA

N80-15668# California Univ., Livermore. Lawrence Livermore Lab.

IDENTIFICATION OF ENVIRONMENTAL CONTROL TECHNOLOGIES FOR GEOTHERMAL DEVELOPMENT IN THE IMPERIAL VALLEY OF CALIFORNIA

D. F. Snoeberger and J. H. Hill 5 Oct. 1978 33 p refs
 (Contract W-7405-eng-48)
 (UCRL-52548) Avail: NTIS HC A03/MF A01

Control technologies to manage environmental impacts from geothermal developments in California's Imperial Valley are discussed. Included are descriptions of methods for managing land subsidence by fluid injection; for preventing undesirable induced seismicity or mitigating the effects of seismic events; for managing liquid wastes through pretreatment or subsurface injection; for controlling H₂S by dispersal, reinjection, and chemical treatment of effluents; and for minimizing the impact of noise from power plants by setting up buffer zones and exclusion areas. DOE

N80-15669# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: ELECTRIC ENERGY SYSTEMS

Aug. 1979 58 p refs
 (DOE/EDP-0038) Avail: NTIS HC A04/MF A01

The Electric Energy Systems (EES) program is discussed. The program includes the following projects: electric field effects, underground transmission, high-voltage dc technology, advanced transformer and generator concepts, compact stations, and dispersed storage and generation. The projects were examined to identify their environmental impact and the resulting concerns. Management plans for meeting the environmental requirements are identified, along with the organizations responsible for managing the environmental research associated with the EES program. DOE

N80-15670# Oak Ridge Associated Universities, Tenn.
DEVELOPMENT OF THE ROCKY MOUNTAIN ENERGY AND ENVIRONMENTAL TECHNOLOGY CENTER: A PRELIMINARY ANALYSIS

T. McKinley, J. Doggett, and J. Little Jun. 1979 34 p
 (Contract EY-76-C-05-0033)
 (ORAU-158) Avail: NTIS HC A03/MF A01

The events that contributed to the evolution of RME and ETC are emphasized. All of the organizations which have aided the development of RME and ETC are identified. The private and shared agendas of each are explored. A historical synopsis is presented to provide a chronological time frame for program development. Training programs in machining, word processing, and chemical operating are described. Characteristics of the total 79 trainees enrolled are presented; terminations and placements to date are cited. RME and ETC represents one coordinated approach to industry-based CETA skills training. The key elements that contributed to the current RME and ETC are identified. Recommendations are offered for present and future program implementation. DOE

N80-15676# Hittman Associates, Inc., Columbia, Md.
ENVIRONMENTAL ASSESSMENT REPORT: SOLVENT REFINED COAL (SRC) SYSTEMS Final Report, May 1978 - May 1979

K. J. Shields, H. T. Hopkins, E. E. Weir, and Carolyn Thompson Jun. 1979 847 p
 (Contract EPA-68-02-2162)
 (PB-300383/7; EPA-600/7-79-146) Avail: NTIS HC A99/MF A01 CSCL 13B

Air emissions, water effluents, solid wastes, toxic substances, control/disposal alternatives, environmental regulatory requirements, and environmental effects associated with solvent refined coal (SRC) systems are evaluated. The SRC-1(solid product) and SRC-11(liquid product) variations of solvent refining are considered in terms of a hypothetical facility to produce 7950 cum/day liquefied coal products. Control and disposal options are surveyed to determine their applicability to subject discharges. Potentially applicable regulatory requirements are reviewed and compared to estimated after-treatment discharge levels. Analyses indicate that solid wastes produced by SRC systems are the greatest source of current environmental concern. GRA

N80-15681# Mathtech, Inc., Princeton, N. J.
EVALUATION OF THE ENVIRONMENTAL EFFECTS OF WESTERN SURFACE COAL MINING, VOLUME 1 Final Report, Jun. 1975 - Jun. 1977

Frank Cook May 1979 154 p refs
 (Contract EPA-68-03-2226)
 (PB-300375/3; EPA-600/7-79-110-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

The methods presently used for surface mining of coal in the western United States are described and evaluated. The effects that use of those methods have on the environment are described and ways in which the methods might be altered to reduce both long term and short term environmental damage are presented. GRA

N80-15682# PEDCo-Environmental, Inc., Cincinnati, Ohio.
EPA UTILITY FGD (FLUE GAS DESULFURIZATION) SURVEY: DECEMBER 1978 - JANUARY 1979

M. Smith, M. Melia, T. Koger, R. McKibben, and J. Uihlein May 1979 453 p refs
 (Contract EPA-68-02-2603)
 (PB-299399/6; EPA-600/7-79-022C) Avail: NTIS HC A20/MF A01 CSCL 10B

The scope of design data for operating flue gas desulfurization (FGD) systems is expanded, section formats are revised, and a new section includes operational particulate scrubbers. Information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms is summarized. Systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process, waste disposal practice, and regulatory class. Data on system design, fuel sulfur content, operating history, and actual performance are presented as well as unit by unit

dependability parameters. Problems and solutions associated with the boilers and FGD systems are considered. Process flow diagrams and FGD system economic data are appended. Current data show 46 operating FGD systems, 45 systems under construction, and 67 planned units. Projected 1988 FGD capacity is about 70,000 MW. GRA

N80-15685# Environmental Monitoring and Support Lab., Las Vegas, Nev.

WESTERN ENERGY SULFATE/NITRATE MONITORING NETWORK Progress Report, Jan. 1975 - Jun. 1978

Michael J. Pearson, Marc Pitchford, and Robert Snelling Mar. 1979 50 p refs
(PB-299238/6; EPA-600/7-79-074) Avail: NTIS HC A03/MF A01 CSDL 13B

Little sulfate-nitrate data are available to establish a baseline and evaluate the impact of coal utilization. The number of locations monitoring sulfate and nitrate in the Western Energy Resource Development Area was increased by augmenting the existing particulate sampling networks. To evaluate and improve the quality of data obtained, a quality assurance program was established. The data reported thus far indicate generally low values in this area. Typically, sulfate values are less than 6 micrograms per cubic meter (microgram/cu m) and nitrate values are less than 3 microgram/cu m. GRA

N80-15687# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.

PILOT SCALE EVALUATION OF NO_x COMBUSTION CONTROL FOR PULVERIZED COAL, PHASE 2 Final Report, Jun. 1973 - Jan. 1978

R. A. Brown, J. T. Kelly, and Peter Neubauer Jun. 1979 321 p
(Contract EPA-68-02-1885)
(PB-299325/1; EPA-600/7-79-132; Rept-78/293) Avail: NTIS HC A14/MF A01 CSDL 13B

Advanced NO_x control techniques were investigated on a pilot scale test facility firing pulverized coal. Baseline and control technology tests were performed on three coal types over a range of parameters. First and second stage parameters investigated include stoichiometry, excess air, temperature, mixing residence time, and coal composition. A minimum NO level was achieved at a stoichiometric ratio between 0.75 and 0.85, depending on fuel and furnace configuration, and the longer first-stage residence times gave lower stack NO levels. To obtain NO levels below 150 ppm, first-stage residence times of up to 3 seconds were required. Second-stage parameters were found to be of second-order importance. GRA

N80-15688# Clemson Univ., S.C. Dept. of Mechanical Engineering.

ENERGY CONSERVATION THROUGH POINT SOURCE RECYCLE WITH HIGH TEMPERATURE HYPERFILTRATION Final Report, Jul. 1975 - Dec. 1978

J. L. Gaddis, C. A. Brandon, and J. J. Porter Jun. 1979 187 p refs
(Grant EPA-R-803875)

(PB-299183/4; EPA-600/7-79-131) Avail: NTIS HC A09/MF A01 CSDL 13B

The reuse of water, energy, and chemicals in the textile industry can be best achieved if separations are applied to individual point-source streams rather than to total-plant mixed effluents. Five wet processes comprise a large fraction of total textile operations and require over half of the total energy used. Each process effluent was sampled and analyzed to determine which membrane, hyperfiltration or ultrafiltration, should be used. Two small equipment skids allowed membrane operation at the plant sites. The permeable water in each case was reusable. Estimates of energy recoverable per mass of cloth processed (kJ/kg) for each operation are: rope preparation, 2646; open-width preparation, 5766; continuous dyeing, 2449; atmospheric beck dyeing, 20115; high-pressure dyeing, 3910; and low-pressure beck dyeing, 1964. GRA

N80-15691# Dravo Corp., Pittsburgh, Pa.

MANAGEMENT OF COAL PREPARATION FINE WASTES WITHOUT DISPOSAL PONDS Final Report, Jul. 1977 - Jun. 1978

D. C. Hoffman, R. W. Briggs, and S. R. Michalski Jan. 1979 63 p refs

(Contract DI-G-ET-79-11270)

(PB-299100/8; EPA-600/7-79-007; FE-11270-1) Avail: NTIS HC A04/MF A01 CSDL 13B

The physical/chemical properties of a diverse sampling of fine coal refuse were investigated along with the effect of chemical stabilization. It was shown that chemical stability can be employed to drastically improve some physical/chemical properties of the fine refuse for better handling and disposal. The proprietary chemical, Calcilox (Trademark) additive, is the most effective over the range of samples tested. Portland Type 1 cement is also effective but greatly influenced by waste solids concentration. The final chemical tested, lime, is inferior to the other two chemicals and generally ineffective in improving the fine waste's physical/chemical properties. GRA

N80-15699# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.

INVESTIGATION OF THE EFFECTS OF THE INSTALLATION OF AN OXIDATION CATALYST ON A DIESEL POWERED VEHICLE

Edward Anthony Barth Mar. 1979 20 p
(PB-299928/2; TAEB-79-7) Avail: NTIS HC A02/MF A01 CSDL 13B

The use of an oxidation catalyst in diesel powered vehicles was investigated for its effects on gaseous and particulate emissions, fuel economy, and vehicle performance. K.L.

N80-15758# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

METEOROLOGICAL EFFECTS OF OIL REFINERY OPERATIONS IN LOS ANGELES

R. F. Pueschel, F. P. Parungo, E. W. Barrett, D. L. Wellman, and H. Proulx Jul. 1979 68 p refs
(PB-300720/0; NOAA-TM-ERL-APCL-22; NOAA-79081403) Avail: NTIS HC A04/MF A01 CSDL 04B

From airborne in situ measurements of gases and aerosol size distributions and from post-flight chemical analyses of sample particles, it was found that oil refinery operations in southern Los Angeles can modify clouds in the vicinity. The refinery effluents increased the concentration of aerosols in the size range between 0.05 micro m and 23.5 micro m particle radius. Furthermore, although the sulfate aerosol in the area has a stabilizing effect on clouds, the clouds downwind of the refineries were found to be destabilized by the nitrate aerosol. GRA

N80-15893# Department of Energy, Washington, D. C. Office of Nuclear Energy Programs.

FSSION ENERGY PROGRAM OF THE U.S. DEPARTMENT OF ENERGY, FY 1980

Apr. 1979 315 p refs
(DOE/ET-0089) Avail: NTIS HC A14/MF A01

The fission energy program and program objectives are discussed. The program management and program strategy are described and the program budget is presented. The topics in the program which are discussed include thermal reactor technology, advanced isotope separation technology, water cooled breeders, gas cooled breeders, and space power applications. A.W.H.

N80-15897# Brookhaven National Lab., Upton, N. Y.

FUSION ENERGY FOR HYDROGEN PRODUCTION

J. A. Fillo, J. R. Powell, M. Steinberg, R. Benenati (N.Y. Polytechnic Inst.), V. Dang (Burns and Roe), S. Fogelson (Burns and Roe), H. Isaacs (Burns and Roe), H. Kouts (Burns and Roe), M. Kuschner (Burns and Roe), and O. Lazareth 1978 7 p refs Presented at the 10th Symp. on Fusion Technol., Padova, Italy, 4-8 Sep. 1978

(Contract EY-76-C-02-0016)

(BNL-24906; CONF-780953-6) Avail: NTIS HC A02/MF A01

The use of thermonuclear fusion for the production of hydrogen from water is described. A conceptual design coupling fusion with high temperature electrolysis for the production of hydrogen is examined. Elements in the systems' design discussed are the fusion blanket, the high temperature electrolyzers, the coupling of the fusion and electrolyzer systems, and the power conversion system. A.W.H.

N80-15908# Sandia Labs., Albuquerque, N. Mex.

PULSED POWER FOR FUSION

T. H. Martin 1979 7 p refs Presented at the Pulsed Power Conf., Lubbock, Tex., 12 Jun. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0933C; CONF-790622-7) Avail: NTIS
HC A02/MF A01

Research conducted in support of the pulsed power approach to fusion resulted in the creation of an extendable accelerator technology that could be used at levels up to 100 TW and 30 MJ. These types of accelerators are efficient (about 30 to 50 percent) and for ion outputs in the 1 to 3 MJ range they may provide an approach to economically feasible 200 MW electric power reactor. Repetitive pulsing of the pulsed power system for > 10 to the 9th power short lifetimes must be solved along with ion beam concentration, bunching, and drifting. DOE

N80-15933# California Univ., Livermore. Lawrence Livermore Lab.

SUPERCONDUCTIVITY FOR MIRROR FUSION

C. D. Henning Sep. 1978 23 p Presented at Appl. Superconductivity Conf., Pittsburgh, 25 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81693; CONF-780952-39) Avail: NTIS
HC A02/MF A01

The use of mirror magnets in fusion reactors due to the high and steady magnetic fields they generate and the capacity to negate pulsed field is discussed. The past and present development of mirror magnets is reviewed and mirror fusion experiments are reported. A.W.H.

N80-15942# Argonne National Lab., Ill.

TECHNICAL SUPPORT FOR OPEN-CYCLE MHD PROGRAM Progress Report, Apr. - Jun. 1978

D. H. Bomkamp, ed. Jul. 1979 76 p ref
(Contract W-31-109-eng-38)
(ANL/MHD-78-11) Avail: NTIS HC A05/MF A01

The analysis of a magnetohydrodynamic/steam system is discussed. The major components of the system are examined including the combustor, the nozzle channel diffuser, the slag separator, and the high temperature air heaters. The development of a model for the heat transfer and slag flow and a model to estimate the effective emissivities and absorptivities of coal combustion gas containing slag droplets are discussed. A.W.H.

N80-15946# General Accounting Office, Washington, D. C. Energy and Minerals Div.

FUSION: A POSSIBLE OPTION FOR SOLVING LONG-TERM ENERGY PROBLEMS

28 Sep. 1979 60 p
(PB-300692/1; EMD-79-27) Avail: NTIS HC A04/MF A01
CSCL 18A

The concepts of nuclear fusion and the nuclear fusion reactor are reviewed. The topics addressed are plasma confinement, fusion-fission hybrid reactors, and thermonuclear power generation. A.W.H.

N80-15992# Commerce Dept., Washington, D.C. Industry and Trade Administration.

PETROCHEMICALS: THEIR ECONOMIC SIGNIFICANCE IN THE DOMESTIC ECONOMY

Harry Pfann Jul. 1979 91 p refs
(PB-299733/6) Avail: NTIS HC A05/MF A01 CSCL 05C
The economic significance of petrochemicals within the domestic economy is considered along with their importance in

U.S. export trade and their requirements for energy and feedstocks. The importance of fuels and of feedstocks to the industry is noted and data are presented on the quantity of hydrocarbons which are used by the industry for both feedstocks and as energy. GRA

N80-15993# Department of Energy, Washington, D. C. Office of Analytical Services.

REPORT TO CONGRESS ON THE ECONOMIC IMPACT OF ENERGY ACTIONS AS REQUIRED BY PUBLIC LAW 93-275, SECTION 18-D

Sep. 1978 198 p
(DOE/PE-0007) Avail: NTIS HC A09/MF A01

Economic impact analyses are summarized for: (1) two regulatory changes pertaining to crude oil production in California; (2) a change in price regulations for resale of crude oil; and (3) energy efficiency targets for 13 appliances. A recommendation is presented for Federal Programs of employment or economic assistance to minimize the effect of energy shortages or energy actions. K.L.

N80-15994# Committee on Science and Technology (U. S. House).

TOWARD THE ENDLESS FRONTIER: HISTORY OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY 1959 - 1979

Ken Hechler 1980 1107 p refs
(GPO-35-120) Avail: SOD HC

The history of the Committee on Science and Technology is reviewed from its beginning in 1959 through the year 1979. Topics include space missions, space science, international scientific cooperation, energy technology, aeronautics and transportation, and natural resources and the environment. A.W.H.

N80-15995# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY STORAGE SYSTEM FOR AUTOMOBILE PROPULSION, 1978 STUDY. 2: DETAILED REPORT

E. Behrin, C. J. Anderson, H. Bomelburg, M. Farahat, H. C. Forsberg, C. L. Hudson, B. C. Kullman, L. G. O'Connell, G. Strickland, and W. J. Walsh 15 Dec. 1978 294 p refs
(Contract W-7405-eng-48)
(UCRL-52553-Vol-2) Avail: NTIS HC A13/MF A01

The results for FY 1978 of a national, multilaboratory study of energy storage propulsion systems for automobiles are presented including an evaluation of how changing the relationship between specific peak power and specific energy affects electric vehicle performance. Also included are an update of previous results based on new information obtained from ongoing research and development programs, as well as the results of a national energy impact and market penetration analysis of representative future energy storage vehicles. DOE

N80-16004# National Bureau of Standards, Washington, D.C. National Engineering Lab.

INTERNATIONAL ACTIVITIES: THE FISCAL YEAR 1978 SURVEY OF INTERNATIONAL PROGRAMS AT NEL

Samuel Kramer and Michael Olmert Aug. 1979 122 p
(PB-300491/8; NBSIR-79-1792) Avail: NTIS
HC A06/MF A01 CSCL 05A

An international survey of engineering research activities is presented. Production engineering, communications, electron devices, fiber optics, ergonomics, housing and construction, fire safety engineering, materials engineering, cryogenics, alternative energy sources, electron microscopy, and superconductors are included. M.G.

N80-16022# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Report, 1 Apr. - 30 Jun. 1979

30 Jun. 1979 103 p

(AD-A074885; DME/NAE-1979-2)

Avail: NTIS

HC A06/MF A01 CSCL 01/3

Progress in research applicable to aeronautics is summarized. Specific attention is given to the development of a minicomputer based controller designed for gas pipeline station control. The role of computer models and simulation techniques is emphasized. A railway switch car designed to operate in snow and ice is also described. Design modifications recommended to improve the mechanical performance and endurance of the switch are included.

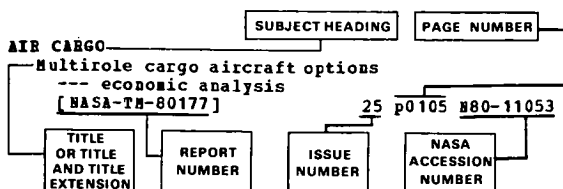
J.M.S.

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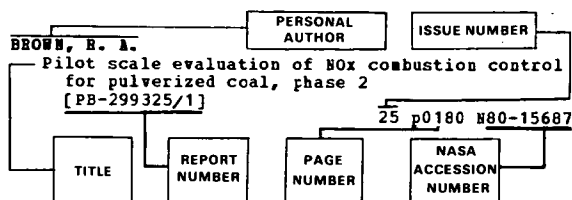
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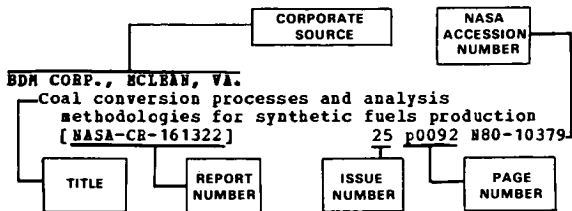
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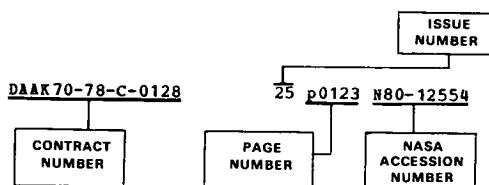
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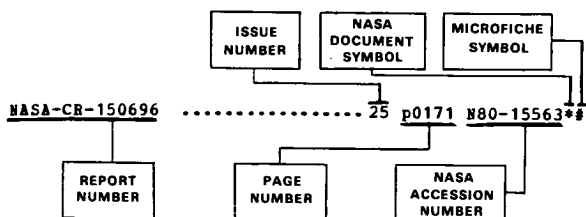
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